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Opuscula Philolichenum

small works in the field of lichenology

MISSION

Opuscula Philolichenum is intended to serve as a venue for the publication of small works in the field of lichenology (including lichenicolous fungi and non-lichenized fungi traditionally treated with lichens). The central goal of the journal is to provide timely publication, in a professional format, free of charge to authors and readers. While the journal focuses on topics relating to the lichen biota of North America this is by no means exclusive and manuscripts on other topics will be considered as the table of contents of the present issue clearly illustrates.

Authors wishing to submit a manuscript for publication in *Opuscula Philolichenum* should contact the editor prior to submission to confirm that the paper conforms to the mission of the journal (outlined above). Manuscript submissions should be left unformatted and authors should consult a recent issue of *Opuscula Philolichenum* for style. All submissions are subjected to review by at least two peer reviewers and, following acceptance are formatted by the editor.

NOTICE FROM THE EDITOR

When this journal began publication ten years ago it was among the first serials to take advantage of the internet when publishing new botanical nomenclatural acts. The journal was conceived as a primarily electronic one, available on-line free of charge (at http://sweetgum.nybg.org/philolichenum/), with a limited print run to satisfy the requirements for effective publication established under the *International Code for Botanical Nomenclature*. Since that time we have continued to publish the journal in this manner, printing one or two issues a year, with each issue consisting of between one and two hundred pages.

In 2004 we could not have foreseen the revolutionary changes that took place at the 18th International Botanical Congress in Melbourne. There the Nomenclature Section voted to allow electronic only publication of new nomenclatural acts beginning 1 January 2012. In response to this change *Opuscula Philolichenum* no longer produces hardcopy. Although a single printed copy will continue to be deposited in the library of The New York Botanical Garden.

Beginning with volume number 12 of *Opuscula Philolichenum*, manuscripts are published electronically on-line in PDF/A format immediately following the approval of the authors in the post-review proof stage. The PDF issued online is considered to be the final version (= version of record) and the date on which the PDF is posted is considered to be the date of effective publication. In order to aid future workers the date of effective publication for each manuscript is provided in the table of contents. When a new manuscript is published online a record is also simultaneously transmitted to the organizers of *Recent Literature on Lichens* for inclusion in that database.

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Calicioid lichens and fungi of the Gifford Pinchot and Okanogan-Wenatchee National Forests in Washington, U.S.A.

AMANDA HARDMAN[1], DAPHNE STONE[2] AND STEVEN B. SELVA[3]

ABSTRACT. – National Forest lands in the state of Washington were surveyed for calicioid lichens and fungi. Sixty-four plots were investigated and 930 collections were made. Fifty-seven species in nine genera were found, including *Chaenothecopsis lecanactidis*, *C. nivea*, *C. vainioana*, and *Phaeocalicium interruptum*, which are reported as new to North America. *Chaenothecopsis norstictica* and *C. nigra* are reported as new to western North America. Our observations confirm conclusions drawn by others that forests with the highest structural diversity have the highest number of calicioid species present.

KEYWORDS. – Calicioid, *Calicium*, *Chaenotheca*, *Chaenothecopsis*, *Cyphelium*, Gifford Pinchot National Forest, *Microcalicium*, *Mycocalicium*, Okanogan-Wenatchee National Forest, old growth, *Phaeocalicium,* pin lichens, *Sclerophora*, *Stenocybe*.

INTRODUCTION

Calicioids, often called "pin lichens" or "stubble lichens" because of their tiny, generally less than two millimeter tall, pin-like apothecia, are a polyphyletic group of lichens and nonlichenized fungi (Prieto & Wedin 2016). In most species, minute stalks raise the spore-bearing capitula above the substrate, thus promoting the dispersion of spores to new locations. Lichenologists treat calicioid lichens and fungi as a group because they look similar, grow together, and are often collected together. Major differences include nutritional strategies and spore release mechanisms (Tibell 1984). Genera of lichenized calicioids in the Pacific Northwest include *Calicium*, *Chaenotheca*, *Cyphelium*, *Sclerophora*, *Sphaerophorus, Texosporium*, *Thelomma*, and *Tholurna*. They form relationships with a diversity of algae, including *Dictyochloropsis*, *Stichococcus*, *Trebouxia*, and *Trentepohlia,* and grow as epiphytes on the bark and wood of trees and shrubs, on rocks, and on the surfaces of shelf fungi. All of the lichenized species have asci that disintegrate to disperse spores passively. The ruptured asci and spores collect in a powdery mass, the mazaedium, at the top of the capitulum (Tibell 1984). The nonlichenized calicioid genera in the Pacific Northwest include *Bruceomyces*, *Chaenothecopsis*, *Microcalicium*, *Mycocalicium*, *Phaeocalicium*, *Sphinctrina*, and *Stenocybe*. They may be saprophytic on vascular plants, parasitic on free-living algae or lichens, or commensalistic on lichens. All have similar pin-like apothecia, but in most genera the asci do not disintegrate but instead release their spores through an opening at the tip of the ascus. Nonlichenized genera that do form mazaedia include *Bruceomyces*, *Microcalicium*, and *Sphinctrina* (Tibell 1999, Rikkinen 2003b).

Because of their small size and a lack of comprehensive regional identification keys, collection and identification have been a challenge. Few focused inventories have been made to document their presence in the region. Peterson (2000) studied calicioid species in low-elevation sites of the western

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Oregon Cascades and Rikkinen (2003a) collected them in California, Oregon, and Washington, though only three of his sites were in Washington. Surveys required under the federal Northwest Forest Plan (USDA and USDI, 1994) have yielded additional records. A limited number of calicioid collections from the region can also be found in the online database of the Consortium of Pacific Northwest Herbaria (2016), especially for the area east of Seattle, as well as on state and provincial lichen checklists.

As collectors continue to add new calicioid records from the states and provinces of western North America, regional identification keys have started to emerge (e.g., Goward 1999, Peterson 2012). Though recognized as still incomplete, collectors continue to complement them with taxonomic resources from around the world, particularly those that focus on calicioid species in the northern hemisphere (e.g., Groner 2006; Selva 1988, 2013, 2014;, Selva & Tibell 1999; Stordeur et al. 2010; Tibell 1975, 1980, 1999; Tibell & Ryman 1995; Tibell & Titov 1995; Titov & Tibell 1993).

The goal of the present study is to enhance our understanding of calicioid lichens and fungi in the Pacific Northwest. We focused on two national forests in Washington State, the Gifford Pinchot National Forest and the Okanogan-Wenatchee National Forest. These forests include calicioid habitats and substrates that can be found throughout the eastern and western Cascade ecoregions. The Okanogan-Wenatchee National Forest, which lies in the north-central part of the state, encompasses over 16,187 square kilometers and extends southward along the eastern slopes of the Cascade Range from the Canadian border to the Goat Rocks Wilderness 290 kilometers away. Being on the leeward side of the mountains, it incurs dry, continental conditions caused by the rain shadow effect. Gifford Pinchot National Forest, which lies in the southwestern part of the state, encompasses 5,342 square kilometers and extends 116 km along the western slopes of the Cascade Range from Mount Rainier National Park to the Columbia River. Although its eastern boundary lies on the leeward side of the mountain crest, air currents from the Columbia River Gorge provide greater moisture than would otherwise be available.

MATERIALS AND METHODS

In August of 2013 Ron Hamill, Amanda Hardman, and Daphne Stone, of Stone Ecosurveys LLC and Jeanne Ponzetti, a lichenologist from Olympia, WA, sampled plots located on the Mount Adams and Cowlitz Valley Ranger Districts of the Gifford Pinchot National Forest and the Naches Ranger District of the Okanogan-Wenatchee National Forest in southwest Washington State (Figure 1).

Because our intent was to explore calicioid diversity, we located plots in habitats likely to harbor a high diversity of species. It is well established that calicioid diversity and abundance increases with stand age and time without disturbance (Tibell 1992, Selva 1994, Caruso and Rudolphi 2009, Fritz et al. 2008, Ranius et al. 2008, Lõhmus & Lõhmus 2011, Peterson et al. unpublished); therefore, we targeted stands older than 80 years using Geographic Information System (GIS) data provided by the Forest Service. We selected plots with large-diameter trees and snags indicative of late seral stage to old-growth forest, either within a forest, along a forest edge, or in wetlands with scattered conifers. Site selection criteria included a minimum distance of 45 m (150 ft) from well-used roads and at least 0.8 km (0.5 miles) between plots. Plot size was not predefined; instead we continued to sample at each plot until no new species were detected after 10 to 15 minutes had passed.

A combination of taxonomic resources (Groner 2006; Peterson 2012; Rikkinen 2003b; Selva 2014; Selva and Tibell 1999; Stordeur et al. 2010; Tibell 1987, 1999; Tibell and Titov 1995; Titov and Tibell 1993) was used to identify specimens. Confirmations of difficult specimens were made by Dr. Steven Selva and Dr. Eric Peterson. Identified samples of each species were deposited in the University of Washington Herbarium (WTU), and a second, less complete collection was deposited in the Oregon State University Herbarium (OSC).

A species-area curve and jackknife estimates were calculated and visualized with PC-ORD (McCune & Mefford, 2011), to assess how well our sample size captured species diversity across the project area. We calculated first and second-order jackknife estimates to predict the total number of species in the project area (Palmer 1990, 1991). The jackknife estimates of species richness add a correction factor to the total number of observed species to predict how many species may be in the sample area. The first-order estimate calculates the correction factor based on how many species were found on only one plot, while the second-order estimate is based on the number of species found on one plot and the number of species found on only two plots.

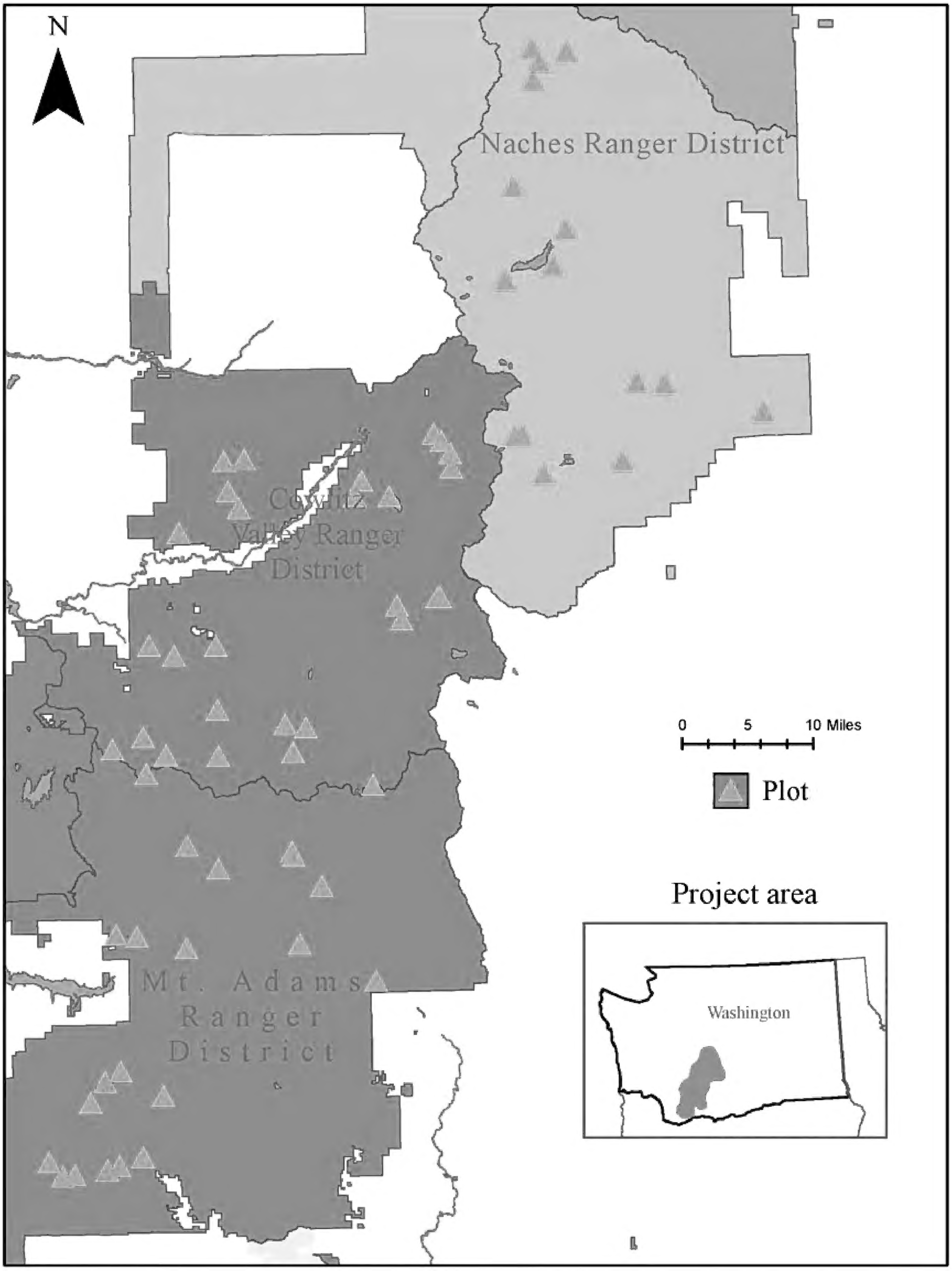

Figure 1. Map of study area illustrating boundaries of the National Forest lands, division of National Forest ranger districts, and locations of plots (yellow triangles).

Figure 2. Example of nonforested wet meadow with shrubs and scattered conifers (study plot 12A, Cowlitz Valley Ranger District, Gifford Pinchot National Forest, Lewis County, Washington).

RESULTS AND DISCUSSION

A total of 64 plots were surveyed, 48 in the Gifford Pinchot National Forest and 16 in the Okanogan-Wenatchee National Forest. The elevation of the plots ranged from 345 m (1132 ft) to 1920 m (6300 ft), with an average elevation of 981 m (3220 ft). Most of the plots were located in forests dominated by conifers. Although hardwoods were commonly present as an understory component, hardwood-dominated plots were rare, which corresponds to data reported by Franklin amd Dyrness (1973). Over 70% of the plots were in the *Abies amabilis* or *Tsuga heterophylla* forest zones (Franklin & Dyrness 1973). The remaining forests sampled were those in the *Abies grandis*, *Abies lasiocarpa*, *Tsuga mertensiana*, and *Pseudotsuga menziesii* zones (Franklin & Dyrness 1973). Nonforested wet meadows with shrubs and scattered conifers were also included (Figure 2).

A total of 57 calicioid species, in nine genera, were identified among the 930 specimens collected in the survey. Four of these species, *Chaenothecopsis lecanactidis*, *C. nivea*, *C. vainioana*, and *Phaeocalicium interruptum* represent new records for North America. Two species, *Chaenothecopsis norstictica* and *C. nigra* are new records for western North America.

The species-area curve had a relatively level slope at higher plot count values (Figure 4B), suggesting that collecting from additional plots would not have significantly increased overall species richness. The jackknife estimates of species richness support that conclusion as well. The first-order jackknife estimate of species richness predicted that there would be a total of 71 species collected in the survey, suggesting we captured 81% of the species. The second-order jackknife estimate of species richness predicted that there would be a total of 78 species, suggesting we collected 74% of them. The average number of calicioid species per plot (alpha diversity) was 15. The plot with the highest number of species (25) was in an old-growth *Tsuga heterophylla*-dominated site, with mature *Abies grandis*, *Picea engelmannii*, *Callitropsis nootkatensis*, and *Alnus viridis*. The site was at 1311 m (4300 ft) in elevation in the Okanogan-Wenatchee National Forest. Two plots had 22 calicioid species present, both in the Gifford

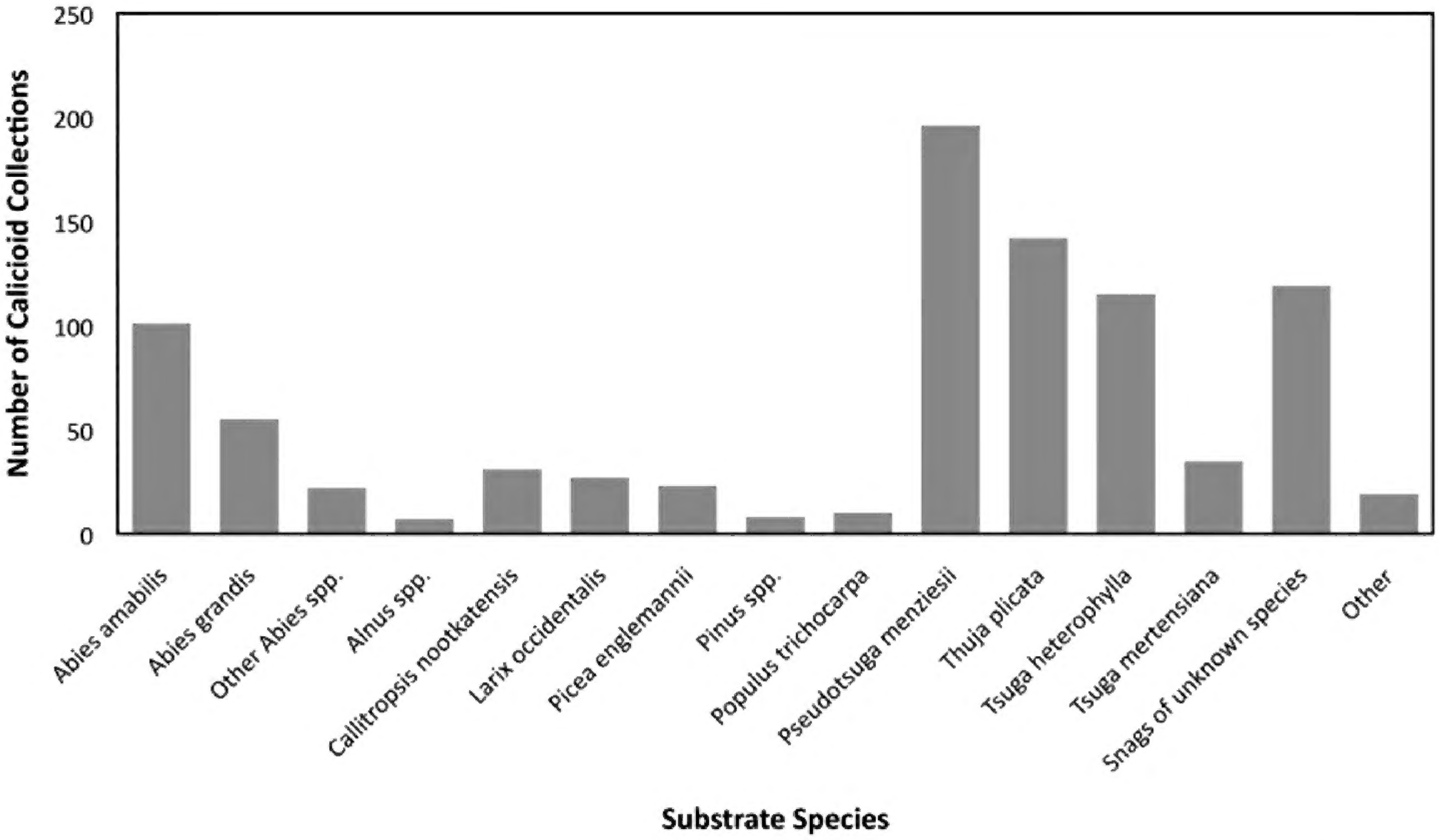

Figure 3. Number of epiphytic calicioid collections found on each substrate species. Note that "Other *Abies* spp." includes *A. lasiocarpa* and *A. procera*; "*Pinus* spp." includes *P. albicaulis, P. contorta, P. monticola* and *P. ponderosa*; "*Alnus* spp." includes *A. incana, A. viridis* and *A. rubra*; and "other" includes substrates less commonly found in our study: *Acer macrophyllum*, *Crataegus* sp., *Sorbus sitchensis*, *Taxus brevifolia, Trichaptum abietinum*, *Chaenotheca chrysocephala, C. furfuracea, C. trichialis,* and *Lecanactis* sp.

Pinchot National Forest. One was a late seral stage stand, on a moderate slope at 927 m (3040 ft) elevation, with a high diversity of conifers, while the other was an old-growth stand at 1090 m (3575 ft) elevation that was dominated by *Tsuga heterophylla*, *Thuja plicata*, and *Pseudotsuga menziesii*, with a younger cohort of *Abies amabilis.* This latter plot also had open swampy areas with *Alnus viridis* throughout. The five most species-rich plots were all located within 57 m (188 ft) of perennial water, which includes creeks, rivers, lakes, and wetlands. Twenty-three species were collected in 10 or more plots (see the appendix).

The substrates colonized by calicioid species in our survey included the bark and wood of boles, branches, roots, and resin of 16 species of living conifers, four species of hardwoods, and two species of shrubs (Figure 3). Snags and logs of unknown species, rocks, polypore fungi, and lichens also served as substrates for calicioid taxa. Most of the collections came from boles of living trees, followed by the boles of snags (Figure 4A). *Pseudotsuga menziesii* was the most common species colonized. Twenty species were found exclusively on conifers, 2 species were found on hardwoods as well as conifers, and 1 species, *Chaenotheca furfuracea*, was found on rock as well as conifers. The calicioid species found on the fewest substrates were *Chaenotheca hygrophila*, which was found on only two different conifer species, and *Phaeocalicium compressulum*, which was found only on *Alnus viridis*.

The alphabetical list of species provided below includes the number of plots in which each species was found and the national forest in which each was found (Gifford Pinchot NF **GIP**, and Okanogan-Wenatchee NF **OKA**). The number of collections from conifers and hardwoods is given in parentheses. Substrate is provided using the following abbreviations: *Abies amabilis* **ABAM**, *Abies grandis* **ABGR**, *Abies lasiocarpa* **ABLA**, *Abies procera* **ABPR**, *Acer macrophyllum* **ACMA**, *Alnus viridis* **ALVI**, *Alnus rubra* **ALRU**, *Callitropsis nootkatensis* **CANO**, *Larix occidentalis* **LAOC**, *Picea engelmannii* **PIEN**, *Pinus albicaulis* **PIAL**, *Pinus contorta* **PICO**, *Pinus monticola* **PIMO**, *Pinus ponderosa* **PIPO**, *Pseudotsuga menziesii* **PSME**, *Populus trichocarpa* **POTR**, *Taxus brevifolia* **TABR**, *Thuja plicata* **THPL**, *Tsuga heterophylla* **TSHE**, and *Tsuga mertensiana* **TSME.** Additional relevant information, including new reports for North America and representative specimens that were deposited in WTU and OSC, is also provided. Initials of collectors are abbreviated as follows: RH= Ron Hamill, AH= Amanda Hardman, JP= Jeanne Ponzetti and DS= Daphne Stone.

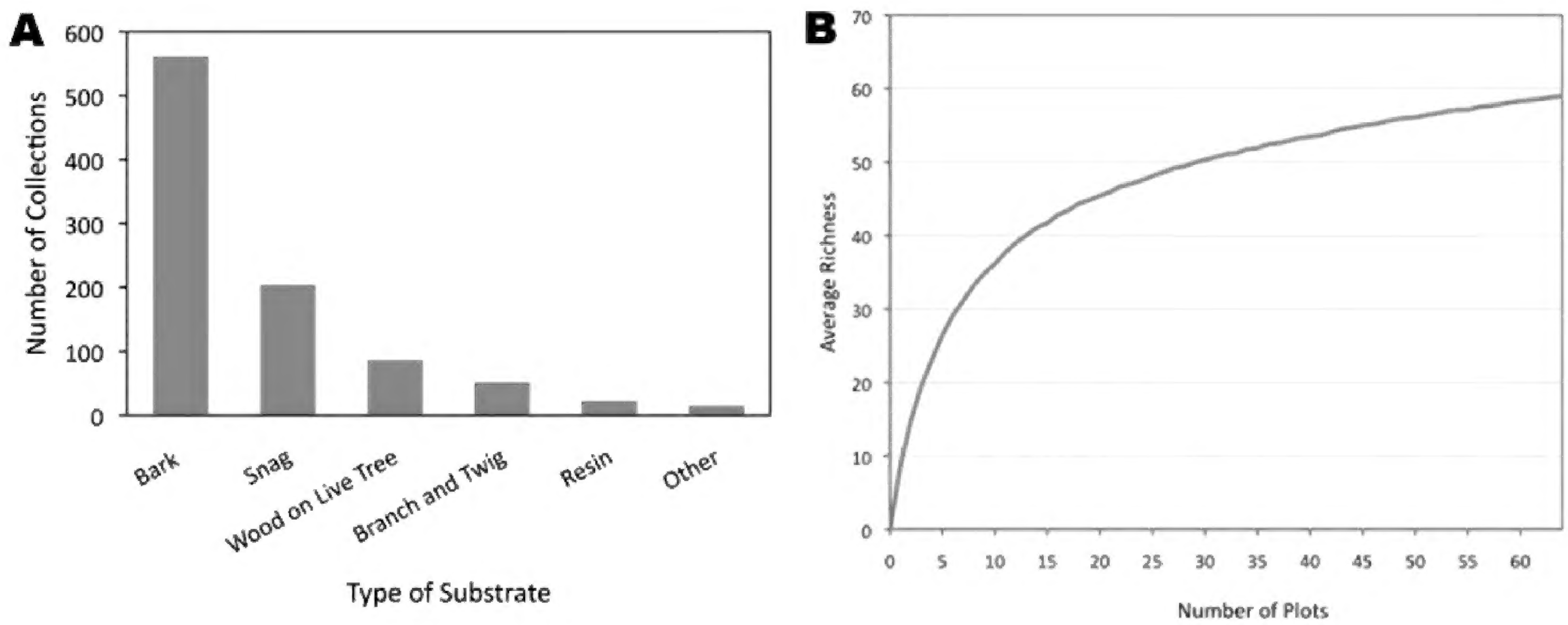

Figure 4. A, number of collections from each type of substrate (snag value includes wood, bark and resin on snags; branch and twig, wood, and bark represent specific substrate types on live trees; "other" includes substrates from which no more than 4 collections were made, including rock, roots, lichen and fungus). **B,** species-area curve used to assess how well the study sample size captured project-wide species diversity, using repeated sampling of a fixed sample (in this case 64 plots and 57 species).

Calicium adaequatum Nyl.

12 Plots: GIP, OKA. Conifers (2): twigs of CANO and PSME. Hardwoods (12): twigs/branches of ACMA, ALIN, ALRU, and *Crataegus* sp. WTU: RH 389 and RH 1006; OSC: AH 6028.

Calicium glaucellum Ach.

33 Plots: GIP, OKA. Conifers (67): bark and wood of ABAM, ABGR, CANO, LAOC, PICO, PIMO, PIPO, PSME, THPL, TSHE, and snag boles. WTU: AH 6101; OSC: JP 323.

Calicium lenticulare Ach.

2 Plots: GIP, OKA. Conifers (2): bark and wood of THPL bole, and bark of PSME bole. WTU: AH 6070; OSC: AH 6093.

Calicium viride Pers.

30 Plots: GIP, OKA. Conifers (75): bark and wood of ABAM, ABGR, ABLA, CANO, LAOC, PIEN, PSME, THPL, TSHE, TSME, and snag boles. WTU: DS 436.5; OSC: AH 6071.

Chaenotheca balsamconensis J.L. Allen & McMullin

2 Plots: GIP, OKA. On the shelf fungus *Trichaptum abietinum* (3). This is a newly described species (Allen & McMullin 2015). We suggest reviewing herbarium collections of *Chaenotheca ferruginea* (the name most likely misapplied to *C. balsamconensis*) growing on fungi to catch misidentified material. WTU: RH 202; OSC: RH 361.2.

Chaenotheca brachypoda (Ach.) Tibell

8 Plots: GIP, OKA. Conifers (12): bark and wood of CANO, PSME, THPL, TSHE, and snag boles. Hardwoods (1): bark of POTR bole. WTU: RH 200.1; OSC: AH 6029.

Chaenotheca brunneola (Ach.) Muell. Arg.

40 Plots: GIP, OKA. Conifers (121): bark and wood of ABAM, CANO, PIEN, PIMO, PSME, THPL, TSHE, and TSME boles; branches of LAOC and PSME. WTU: AH 6153; OSC: AH 6078.

Chaenotheca chlorella (Ach.) Muell. Arg.

10 Plots: GIP, OKA. Conifers (14): bark and wood of ABAM, PIEN, PSME, THPL, TSHE, and TSME boles. WTU: DS 465.2; OSC: DS 465.2 dup.

Figure 5. Snag with scar hosting *Chaenotheca chlorella, C. trichialis* and *Chaenothecopsis epithallina* (from study plot 5A, Cowlitz Valley Ranger District, Gifford Pinchot National Forest, Skamania County, Washington).

Chaenotheca chrysocephala (Turner ex Ach.) Th.Fr.
19 Plots: GIP, OKA. Conifers (32): bark and wood of ABAM, CANO, PSME, THPL, TSHE, and TSME boles. WTU: AH 6109 and JP 323; OSC: JP 338.4.

Chaenotheca cinerea (Pers.) Tibell
4 Plots: GIP, OKA. Conifers (10): bark of CANO and THPL boles, and wood of unknown snag. Hardwoods (1): bark of POTR bole. WTU: RH 161.1; OSC: RH 1002.4.

Chaenotheca ferruginea (Turner ex Ach.) Mig.
2 Plots: GIP, OKA. Conifers (2): bark of THPL and PSME boles. WTU: DS 461.2.

Chaenotheca furfuracea (L.) Tibell
11 Plots: GIP, OKA. Conifers (13): bark and wood of PSME, THPL, and TSHE boles, rootlets, and twigs. Also on rock (3). WTU: RH 399; OSC: AH 6151.

Chaenotheca gracilenta (Ach.) Mattsson & Middleb.
3 Plots: GIP. Conifers (4): bark and wood of PSME and THPL boles. Also on rock (1). WTU: DS 484.

Chaenotheca gracillima (Vainio) Tibell
16 Plots: GIP, OKA. Conifers (21): bark and wood of ABAM, ABGR, PSME, and TSHE boles and rootlets of unknown snag. WTU: DS 198; OSC: JP 296.

Chaenotheca hispidula (Ach.) Zahlbr.
1 Plot: OKA. Conifer (1): bark of PIEN bole. WTU: DS 437.3.

Chaenotheca hygrophila Tibell
10 Plots: GIP. Conifers (13): Mostly on wood but also on bark of PSME and THPL boles. WTU: AH 6082; OSC: JP 386 and AH 6155.

Chaenotheca laevigata Nádv.
13 Plots: GIP, OKA. Conifers (22): wood of ABGR and THPL branches, bark and wood of ABAM, CANO, PSME, THPL, TSHE, and TSME boles. WTU: RH 365; OSC: RH 369.1.

Chaenotheca nitidula Tibell
14 Plots: GIP, OKA. Conifers (16): wood of ABAM, PSME, and unknown snag boles, bark of THPL and TSHE boles. Hardwood (1): bark of POTR bole. WTU: AH 6060; OSC: RH 145.

Chaenotheca phaeocephala (Turner) Th. Fr.
16 Plots: GIP, OKA. Conifers (28): bark of ABAM, ABGR, CANO, LAOC, PIEN, PSME, THPL, TSHE, and TSME boles; resin of ABGR and wood of unknown snag. WTU: AH 6132; OSC: AH 6120.

Chaenotheca stemonea (Ach.) Müll. Arg.
8 Plots: GIP, OKA. Conifers (9): bark of CANO, PSME, THPL, and TSME boles; wood of TSHE bole. WTU: RH 346.

Chaenotheca subroscida (Eitner) Zahlbr**.**
7 Plots: GIP, OKA. Conifers (10): bark of ABAM and ABGR boles. WTU: DS 133.2; OSC: AH 6065.

Chaenotheca trichialis (Ach.) Th. Fr.
21 Plots: GIP, OKA. Conifers (47): wood of ABAM and ABGR twigs, wood and bark of ABGR, LAOC, PSME, THPL, TSHE, and TSME boles, and resin of PSME. WTU: AH 6133; OSC: RH 1009.6.

Chaenotheca xyloxena Nádv.

3 Plots: GIP, OKA. Conifers (3): bark and wood of THPL boles. WTU: AH 6137; OSC: AH 6027.

Chaenothecopsis aeruginosa Goward & E.B. Peterson

1 Plot: OKA. Conifer (1): bark of PSME bole (det. conf. Eric Peterson). The stalk and head appear deep green (aeruginose) under light microscope. WTU: DS 461.1.

Chaenothecopsis "cascadensis" nom. prov. E. B. Peterson (2012a)

5 Plots: GIP, OKA. Conifers (5): bark of ABAM and PSME boles (det. conf. Eric Peterson). It is unique in having tall, narrow apothecia often covered by a blue-white pruina (Peterson 2012). WTU: DS 241.4.

Chaenothecopsis consociata (Nádv.) A.F.W. Schmidt

1 Plot: GIP. On thallus of *Chaenotheca chrysocephala.* WTU: DS 273.2.

Chaenothecopsis debilis (Turner & Borrer ex Sm.) Tibell

2 Plots: OKA. Conifers (2): wood of PIEN bole and PIAL snag. WTU: AH 6134; OSC: AH 6075.

Chaenothecopsis epithallina Tibell

5 Plots: GIP, OKA. Conifers: (5): wood of ABAM twigs, and bark of PSME boles, but most often on thallus of *Chaenotheca chrysocephala*. WTU: AH 6135.

Chaenothecopsis lecanactidis Tibell

1 Plot: GIP. Found on *Lecanactis* sp. (1) over bark of a THPL bole. First described from South America (Tibell 1998), this species is unique in that it is lichenicolous on *Lecanactis* species. Ours is the first record for North America. Stalks of our material do not fit the description of "pale brownish, very pale in the lowermost part," but all other characteristics of *C. lecanactidis* are consistent. We borrowed two Tibell specimens (17784B and 17893, both UPS) to compare with our specimen. We observed that while predominantly pale brown, numerous apothecia in both of the Tibell specimens had dark stalks, some with and some without a paler base. WTU: RH 128.3.

Chaenothecopsis montana Rikkinen

5 Plots: GIP, OKA. Conifers (8): resin of ABAM, ABGR, and TSHE boles. WTU: DS 164.5 OSC: DS 164.6.

Chaenothecopsis nana Tibell

26 Plots: GIP, OKA. Conifers (52): bark of ABAM, ABGR, LAOC, PIEN, PSME, THPL, TSHE, and TSME boles. Less often on wood or resin of ABGR, PIEN, PSME, THPL, or TSME boles. WTU: RH 397; OSC: AH 6156 and JP 488.2.

Chaenothecopsis nigra Tibell

12 Plots: GIP, OKA. Conifers (14): wood of ABAM, THPL and TSHE boles, bark of PSME, THPL, TSHE, and TSME boles. WTU: AH 6073; OSC: JP 1030 and AH 6113.

Chaenothecopsis nigripunctata Rikkinen

7 Plots: GIP. Conifers (9): resin of ABAM, PSME, TSHE, and unknown snag. WTU: RH 371; OSC: RH 371 dup.

Chaenothecopsis nivea (F. Wilson) Tibell

1 Plot: OKA. Conifer (1): bark of THPL bole in a mid-elevation *Pseudotsuga menziesii* forest. This species is previously known only from New Zealand, where it grows on conifers and hardwoods in rain forests. Ours is the first record for North America. WTU: RH 128.4.

Chaenothecopsis norstictica R. C. Harris

1 Plot: OKA. Conifer (1): wood of TSME bole. Ours is the first reported from the west coast of North America. It has been found on *Pinus* and *Thuja* in Florida, Georgia and Maine (Selva 2014). We found it at 1920 m (6300 ft) on the east side of the Cascade crest. This species forms distinctive red norstictic acid crystals in KOH. WTU: AH 6080.

Chaenothecopsis pusilla (Ach.) A.F.W. Schmidt

13 Plots: GIP, OKA. Conifers (17): bark of LAOC, PSME, THPL, TSHE, and TSME boles. WTU: DS 226.3 OSC: DS 226.3 dup.

Chaenothecopsis pusiola (Ach.) Vain.

12 Plots: GIP, OKA. Conifers (27): bark and wood of ABAM, CANO, LAOC, PSME, and unknown snag boles. WTU: RH 1001.1; OSC: RH 1014.1 and JP 496.2.

Chaenothecopsis rubina Tibell

1 Plot: GIP. On thallus of *Chaenotheca furfuracea* over wood at base of TSHE bole. This is a rare species only recently documented from North America (Peterson and Rikkinen 1999). WTU: RH 147.4.

Chaenothecopsis savonica (Räsänen) Tibell

1 Plot: GIP. Conifers (1): on suspended log of unknown species. WTU: DS 262.

Chaenothecopsis tasmanica Tibell

9 Plots: GIP, OKA. Conifers (14): bark of ABGR, PSME, THPL, TSHE, and TSME boles. Hardwoods (2): bark of POTR boles. WTU: JP 515.1; OSC: RH 161.2.

Chaenothecopsis tsugae Rikkinen

5 Plots: GIP. Conifers (7): resin of TSHE and unknown snag. WTU: RH 376; OSC: AH 6067.

Chaenothecopsis vainioana (Nádv.) Tibell

1 Plot: GIP. Conifers (1): growing on wood of unknown snag. Ours is the first record for Washington State. Ron Exeter recently collected the first record for North America from BLM land in western Oregon (Selva pers. com.). Rikkinen (2003a) found 2 specimens he referred to as *Chaenothecopsis* c.f *vainioana* because he was not confident in the identification. WTU: DS 421.2.

Chaenothecopsis "viridipes" nom. prov. E. B. Peterson (2012a)

1 Plot: GIP. Conifer (1): bark of PSME bole (det. conf. Eric Peterson. It is similar to *Chaenothecopsis pusilla* but differs in its usual habitat of bark rather than wood, appearing green rather than brown, never having a pale stalk base, and lacking an association with free-living algae or lichens (Peterson 2012). WTU: RH 178.2.

Cyphelium inquinans (Sm.) Trevisan

24 Plots: GIP, OKA. Conifers (49): bark of ABAM, ABGR, ABLA, CANO, LAOC, PSME, THPL, TSHE, and TSME boles; bark and wood of ABLA, LAOC, THPL, and TSME branches. WTU: AH 6068; OSC: AH 6129 and RH 490.

Cyphelium karelicum (Vainio) Räsänen

4 Plots: GIP, OKA. Conifers (6): bark of ABGR, THPL, and TSHE boles. WTU: RH 513.1; OSC: DS 406.1.

Cyphelium pinicola Tibell

1 Plot: OKA. Conifers (1): wood of PICO branch. WTU: RH 205.

Microcalicium ahlneri Tibell

6 Plots: GIP, OKA. Conifers (10): bark and wood of PSME and THPL boles. WTU: AH 6108; OSC: DS 232.1.

Microcalicium conversum Tibell

8 Plots: GIP, OKA. Conifers (13): bark of LAOC, PSME, THPL, and TSME boles, and wood of unknown snag. WTU: RH 505.1.

Microcalicium disseminatum (Ach.) Vainio

19 Plots: GIP, OKA. Conifers (27): bark of ABAM, LAOC, PSME, THPL, TSHE, and TSME boles. WTU: AH 6126; OSC: AH 6130.

Mycocalicium subtile (Pers.) Szatala

25 Plots: GIP, OKA. Conifers (51): most often on wood of ABAM, ABGR, ABLA, CANO, PIEN, THPL, TSHE, and unknown snag boles, and on bark of ABGR, PIEN, PSME, and THPL boles. WTU: DS 239.2; OSC: AH 6114.

Phaeocalicium compressulum (Nyl. ex Szatala) A.F.W. Schmidt

12 Plots: GIP, OKA. Hardwoods (15): occuring only on bark of ALVI twigs. WTU: DS 282 and JP 472; OSC: AH 6059.

Phaeocalicium interruptum (Nyl.) Tibell

1 Plot: OKA. Hardwoods (1): on bark of *Sorbus sitchensis* twigs. WTU: DS 157.1.

Phaeocalicium populneum (Brond. ex Duby) A.F.W. Schmidt

1 Plot: GIP. Hardwoods (3): bark of POTR twigs. WTU: DS 246; OSC: DS 246 dup.

Sclerophora peronella (Ach.) Tibell

3 Plots: GIP. Conifer (1): wood of TSHE bole. Hardwoods (2): wood of ALRU bole, and bark of POTR bole. WTU: RH 354; OSC: RH 283.

Stenocybe clavata Tibell

11 Plots: GIP, OKA. Conifers (22): bark of ABPR, PSME, TSHE, and unknown snag boles. WTU: JP 330; OSC: AH 6116.

Stenocybe major (Nyl.) Koerber

35 Plots: GIP, OKA. Conifers (70): bark of ABAM, ABGR, ABLA, ABPR, PSME, THPL, and TSHE branches and boles. WTU: RH 218; OSC: DS 409.

Stenocybe pullatula (Ach.) Stein

4 Plots: GIP, OKA. Hardwoods (5): bark of ALRU and ALVI twigs. WTU: JP 480; OSC: RH 438.

Conclusion

As forests age, microhabitats favoring colonization by calicioid lichens and fungi accumulate and the number of calicioid species in the forest increases accordingly (Selva 1994, 2003). Trees become larger and spread further apart, cave-like grottos develop at their bases, and bark becomes more furrowed and acidic while resin flows become more common. Trees die and become snags or topple over and present their root mass for colonization. Colonization of twigs, branches and shelf fungi by calicioid species increases. As forests age changes in light, temperature and humidity contribute to the diversity of microhabitats and promote calicioid species diversity (Peterson 2000, Selva 2003).

It became clear to us that the plots with the highest structural diversity had the highest diversity of calicioid species. For example stands with a mixture of hardwoods and conifer species, small natural openings, multistoried canopies, trees with bark characters that develop over time (deep furrows, scars, resin pockets) or retention of ancient trees and snags increased calicioid diversity (Figure 5). These observations are consistent with the results of previous studies, e.g., Peterson (2000), Tibell (1992), Selva (1994, 2003), McMullin et al. (2008), Ranius et al. (2008), and Lõhmus & Lõhmus (2011).

Acknowledgements

A grant from the Forest Service/Bureau of Land Management Interagency Special Status Sensitive Species Program allowed us to conduct this research. We thank Northwest Lichenologists for facilitating the grant. Many thanks also to Andrea Ruchty Montgomery, Jeanne Ponzetti, Ron Hamill, Dr. Michael C. Russell and Dr. Eric Peterson for their contributions to the project. The Museum of Evolution Herbarium (UPS) graciously lent us specimens. And finally, thank you to the reviewers at Opuscula Philolichenum.

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Appendix – Numbers of occurences and collections per taxon

Included below is a tabular summary of the information provided in the checklist portion of the main body of this contribution. Specifcally for each species we indicate the number of plots the taxon occurred in, as well as the number of collections made, broken down by substrate (confiers, hardwoods and "other").

Species	Number of Plots	Collections on conifers	Collections on hardwoods	Collections on other substrates
Calicium adaequatum	12	2	12	
Calicium glaucellum	33	67		
Calicium lenticulare	2	2		
Calicium viride	30	75		
Chaenotheca balsamconensis	2			On the shelf fungus *Trichaptum abietinum* (3)
Chaenotheca brachypoda	8	12	1	
Chaenotheca brunneola	40	121		
Chaenotheca chlorella	10	14		
Chaenotheca chrysocephala	19	32		
Chaenotheca cinerea	4	10	1	
Chaenotheca ferruginea	2	2		
Chaenotheca furfuracea	10	13		also on rock (3)
Chaenotheca gracilenta	3	4		also on rock (1)
Chaenotheca gracillima	16	21		
Chaenotheca hispidula	1	1		
Chaenotheca hygrophila	10	13		
Chaenotheca laevigata	13	22		
Chaenotheca nitidula	14	16	1	
Chaenotheca phaeocephala	16	27		*Abies grandis* resin (1)
Chaenotheca stemonea	8	9		
Chaenotheca subroscida	7	10		

Species	Number of Plots	Collections on conifers	Collections on hardwoods	Collections on other substrates
Chaenotheca xyloxena	3	3		
Chaenothecopsis "aeruginosa"	1	1		
Chaenothecopsis "cascadensis"	5	5		
Chaenothecopsis consociata	1			on thallus of *Chaenotheca chrysocephala* (1)
Chaenothecopsis debilis	2	2		
Chaenothecopsis epithallina	5	5		most often on thallus of *Chaenotheca chrysocephala*
Chaenothecopsis lecanactidis	1	1		
Chaenothecopsis montana	5			*Abies amabilis, Abies grandis, Tsuga heterophylla* resin (8)
Chaenothecopsis nana	25	52		sometimes on resin
Chaenothecopsis nigra	12	14		
Chaenothecopsis nigripunctata	7	9		
Chaenothecopsis nivea	1	1		
Chaenothecopsis norstictica	1	1		
Chaenothecopsis pusilla	13	17		
Chaenothecopsis pusiola	12	27		
Chaenothecopsis rubina	1			on thallus of *Chaenotheca furfuracea* over wood at base of *Tsuga heterophylla* bole (1)
Chaenothecopsis savonica	1	1		
Chaenothecopsis tasmanica	9	14	2	
Chaenothecopsis tsugae	5			*Tsuga heterophylla* resin (7)
Chaenothecopsis vainioana	1	1		
Chaenothecopsis "viridipes"	1	1		
Cyphelium inquinans	24	49		
Cyphelium karelicum	4	6		
Cyphelium pinicola	1	1		
Microcalicium ahlneri	6	10		
Microcalicium conversum	8	13		
Microcalicium disseminatum	19	27		
Mycocalicium subtile	25	51		
Phaeocalicium compressulum	12		15	
Phaeocalicium interruptum	1		1	
Phaeocalicium populneum	1		3	
Sclerophora peronella	3	1	2	
Stenocybe clavata	11	22		
Stenocybe major	34	70		
Stenocybe pullatula	4		5	

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Lichen biodiversity and ecology in the San Bernardino and San Jacinto Mountains in southern California (U.S.A.)

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ABSTRACT. – San Bernardino National Forest in southern California encompasses two major mountain ranges, the San Bernardino Mountains and the San Jacinto Mountains. Here 414 taxa of lichenized fungi are reported from San Bernardino National Forest as a whole; 327 from the San Jacinto Mountains (including the Santa Rosa Mountains), and 289 from the San Bernardino Mountains. Two species new to science are described: *Lecanora remota* and *Lecidea stratura.* Two undescribed taxa of *Bellemerea* and *Scytinium* are reported, both currently under study. Five species are reported new for North America and California: *Gloeoheppia rugosa*, *Lecanora formosa*, *Peccania cernohorskyi*, *P. corallina* and *Psorotichia vermiculata. Peccania cernohorskyi* is also reported new for Canada (British Columbia). Eight species are reported new for California: *Caloplaca diphasia, C. isidiigera, Peltigera extenuata, Rhizocarpon simillimum, Rinodina lobulata, R. terrestris, Sarcogyne squamosa,* and *Xylographa difformis. Lecidea xanthococcoides* is recognized as a synonym of *Lecanora cadubriae.* The California endemic *Lecidea kingmanii* is reported as producing 4-*0*-demethylplanaic acid. *Polysporina simplex* is treated as *Acarospora simplex* and *P. urceolata* as *A. urceolata*. The new combination *Acarospora gyrocarpa* is proposed for *Polysporina gyrocarpa*.

KEYWORDS. – Acarosporaceae, calciphiles, climate change, fire ecology, fungal diversity, Mojave Desert, Pleistocene, Sonoran Desert.

INTRODUCTION

Lichens (lichenized fungi) are common throughout the state of California and continent of North America. They grow on rocks and in soil crusts, on detritus under chaparral, on the bark of trees and shrubs, on snags and weathered wood, on cement and old ranch fencing and the sun-bleached skulls of dead bighorn sheep. Over 4700 lichens have been reported for North America (Esslinger 2016). A total of 1657 lichen taxa have been reported from California (Tucker 2014). The highest recorded diversity in California

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Figure 1. Overview of the location of the study are (dark green) within the broader context of California.

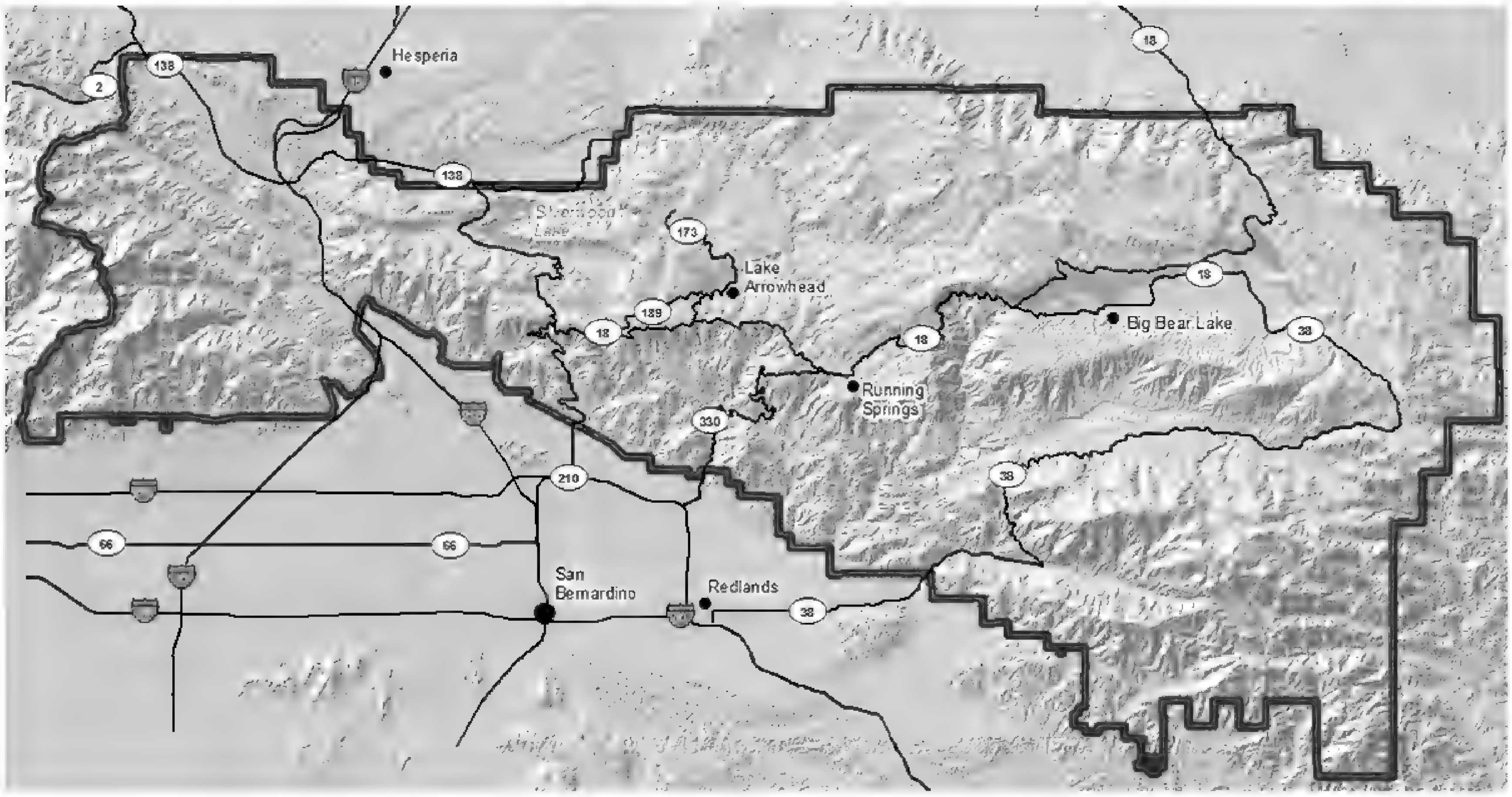

Figure 2. Topogaphic map of the San Bernardino Mountains illustrating the boundary (dark green line) of the nortern unit of San Bernardino National Forest as well as regional population centers and infrastructure.

was in Yosemite National Park with 562 lichens reported (Hutten et al. 2013). Channel Islands National Park had 448 lichen taxa reported (Knudsen & Kocourková 2012). Joshua Tree National Park had 145 lichen taxa (Knudsen et al. 2013a). While there have been three major inventories of National Parks in California, there have been only three limited studies of lichen diversity in the National Forests of California (Carlberg 2013; Knudsen and Kramer 2007; Ryan & Nash 1991). Here we present the results of the first taxonomically comprehensive large-scale study of lichen diversity in any California National Forest, reporting 414 lichen taxa from San Bernardino National Forest in southern California. San Bernardino National Forest in southern California (Figure 1) encompasses two major mountain ranges in southern California, the San Bernardino Mountains (Figure 2) and the San Jacinto Mountains (Figure 3).

The San Bernardino Mountains are part of the Transverse Ranges and are 97 kilometers (60 miles) long, dividing the arid southern California Coastal Plain from the Mojave Desert. On the north end of the San Bernardino Mountains, the Cajon Pass separates the San Bernardino Mountains from the San Gabriel Mountains. The east side of the San Bernardino Mountains is part of the Mojave Desert and has an extensive area of calcareous rock. On the south end San Gorgonio Pass separates the San Bernardino Mountains from the San Jacinto Mountains and Morongo Valley separates them from the Little San Bernardino Mountains. The total area of the San Bernardino Mountains is 5340 km^2 (2063 mi^2). The highest mountain in the range, and southern California, is San Gorgonio at 3505 meters elevation (11499 ft.) (Figure 4A).

The San Jacinto Mountains are the northern end of Peninsular Ranges that stretch 1500 kilometers (932 miles) south to the tip of Baja California in Mexico. The highest mountain in the range is San Jacinto Peak at 3302 meters elevation (10834 ft.) (Figure 4B). To the south of the San Jacinto Mountains in the Peninsular Ranges are the Santa Rosa Mountains, which are also part of San Bernardino National Forest. The western slope of the San Jacinto Mountains interfaces with the coastal plain, includes Thomas Mountain and, extends to Bautista Canyon and the Santa Rosa Hills. The eastern slope of the San Jacinto Mountains is part of the Sonoran Desert (Figure 5).

Across the San Bernardino, San Jacinto and Santa Rosa Mountains, granite is the main rock type. There is a diverse range of microhabitats in ecosystems that range from coastal plain to alpine and desert. Calcareous rock occurs in East Canyon and Rouse Ridge in San Jacinto Mountains and along the Mojave side of the San Bernardino Mountains. The most important vegetation types are chaparral (Figure 6), conifer-oak woodland (Figure 7), conifer forest (Figure 8A), and pinyon-juniper woodland (Figure 8B). The main phorophytes are *Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr., *Calocedrus decurrens* (Torr.) Florin, *Pinus jeffreyi* Balf., and *Quercus kelloggii* Newb. From these ecosystems, microhabitats and phoroph-

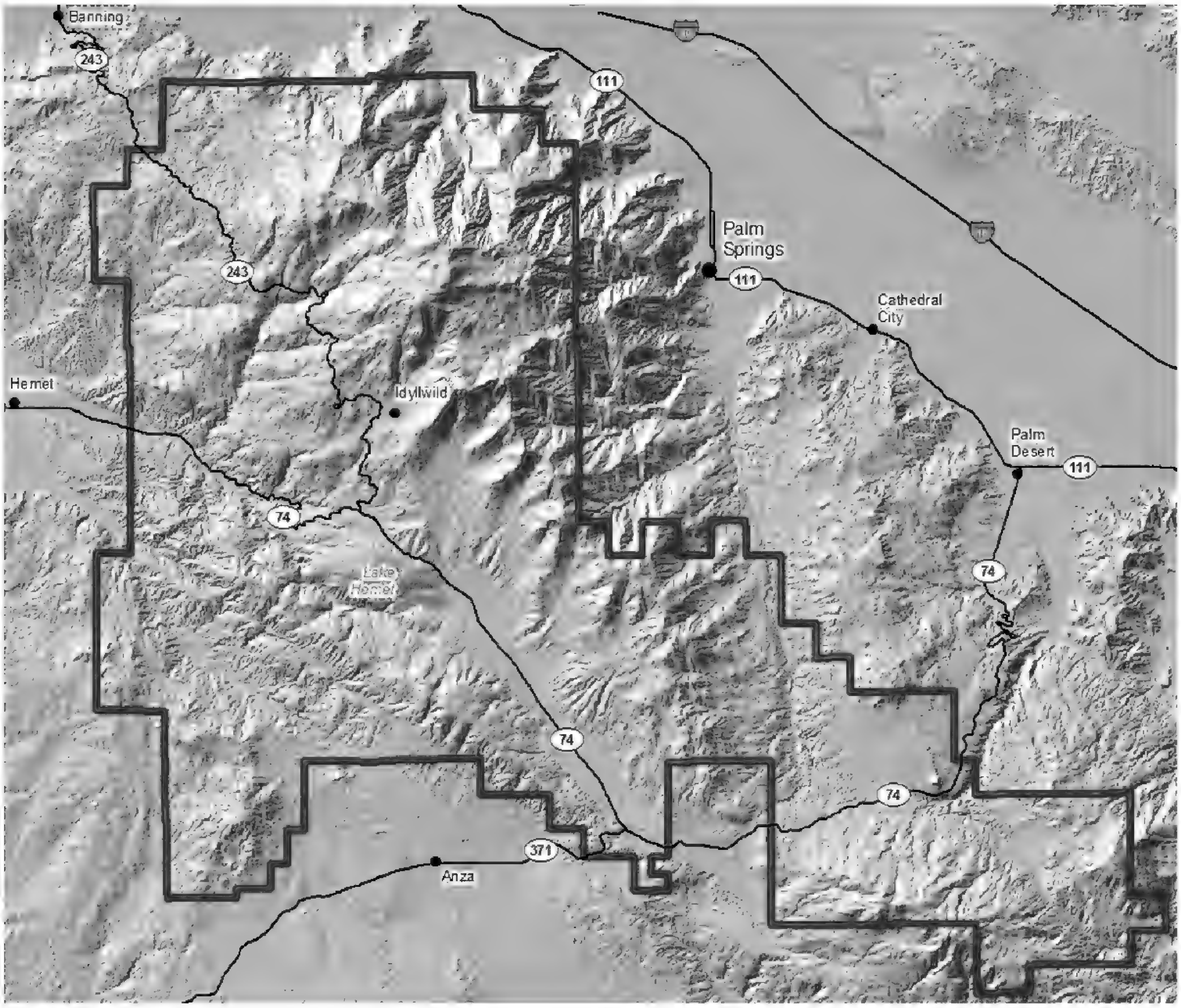

Figure 3. Topogaphic map of the San Jacinto Mountains illustrating the boundary (dark green line) of the southern unit of San Bernardino National Forest as well as regional population centers and infrastructure.

-ytes we here document 289 lichen taxa for the San Bernardino Mountains and 327 lichen taxa for a combination of the San Jacinto and Santa Rosa Mountains.

MATERIALS AND METHODS

FIELD AND HERBARIUM STUDY. – The study covers the San Bernardino National Forest, whose boundary includes most of the San Bernardino and San Jacinto Mountains and a small portion of the San Gabriel Mountains as well as part of the Santa Rosa Mountains and associated foothills. This study also includes species reported outside the National Forest in the Santa Rosa-San Jacinto Mountains National Monument, in Mount San Jacinto State Park, and on private property, all are areas that comprise a natural part of the San Jacinto and San Bernardino Mountains. The majority of lichen specimens documenting this study, over 2500, are deposited in NY, PH, SASK, UCR and the private herbarium of Kocourková and Knudsen (Hb. K&K) and were collected by the authors from 2003 to 2015. The specimens of M. Schultz are deposited in HBG. Over 800 earlier records by a variety of collectors from the 1890′s to 1990′s, were accessed using the databases of CNALH, NY, and UCR during 2015. Only identifications by recognized taxonomic experts were accepted if the specimens were not seen by the authors. Specimens for study were borrowed from BP, FH, and S. Time and funding did not allow an examination of all existing herbarium records. The specimens at UCR from previous publications were revised and any determinations cited in those publications are superseded by the current study (e.g., Knudsen 2005, Knudsen & Kramer 2007). This study does not include lichenicolous fungi or saxicolous microfungi, which are the focus of separate studies.

Figure 4. High elevation montane summits in the study area. **A,** San Gorgonio Peak. **B,** San Jacinto Peak.

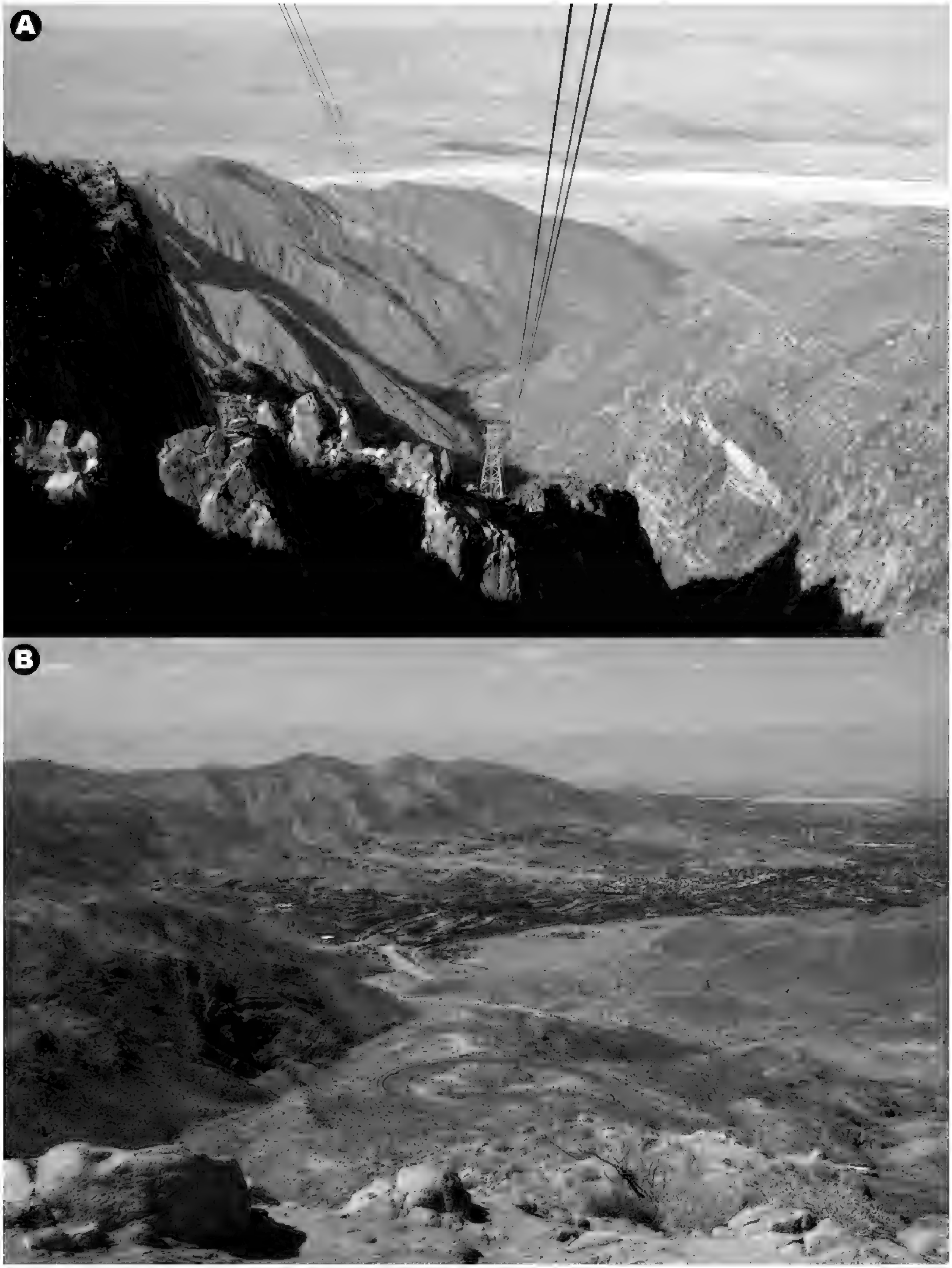

Figure 5. Eastern slope of the San Jacinto Mountains is part of the Sonoran Desert. **A,** East Canyon and Sonoran Desert as seen from the Palm Springs tram to San Jacinto Peak State Park. **B,** City of Palm Desert in Sonoran desert as seen from Seven Level Hill.

Figure 6. Important vegetation types in the study area: chaparral (photo from the San Jacinto Mountains).

Specimens were studied in hand made sections mounted in water and with measurements made in water using standard microscopy techniques. Amyloid reactions were tested with Lugol's (IKI) with or without pretreatment with potassium hydroxide (KOH). Spot tests were performed as in Brodo et al. 2001. Secondary metabolites were studied in Solvent C by Lendemer at NY using thin-layer chromatography (Lendemer 2011). Specimens were identified using the three volumes of the Lichen Flora of the Greater Sonoran Desert Region (Nash et al. 2002, 2004, 2007) unless another source for the description of a species is cited in the "Notes" section. Lichen terminology follows Nash et al. (2002). Lichen photographs by Tim Wheeler were taken with a Pentax K3 DSLR, mounted on a Stackshot rail, and combined in Helicon Focus. Lichen photographs by Matthias Schultz were taken using a Canon EOS 400D camera and Zeiss Luminar 40 mm/4.5 lens mounted on bellows.

MOLECULAR DATA GENERATION, TAXON SAMPLING AND PHYLOGENETIC ANALYSES. – DNA extractions were performed on subsamples of a small number of specimens used following Lendemer (2013b). PCR amplification, sequence generation and sequence assembly for the nrITS and/or mtSSU regions followed Hodkinson and Lendemer (2012). All sequences were subjected to NCBI megaBLAST searches, the results of which are reported where appropriate.

The BLAST for *Lecanora remota* revealed affinities to *L. varia* group, so we constructed an alignment of sequences comprising members of that group following Pérez-Ortega et al. (2010) together with members of the *L. symmicta* included in that publication for use as an outgroup. The alignment was constructed in Mesquite 3.02 (Maddison & Maddison 2015), aligned by hand, and ambiguously aligned regions were defined as part of an exclusion set.

The alignment was prepared for maximum likelihood (ML) analyses by manually deleting the excluded regions, transforming the terminal gaps (-) to missing (?), and transforming any uncertainties or polymorphisms to missing (?) in Mesquite 2.0. The alignment was then exported as a PHYLIP formatted file and a rapid ML topology search and bootstrap analysis with 500 replicates was performed using model GTRGAMMA in RAxML 7.2.6 (Windows executable). The results of the ML analyses (most likely tree, and bootstrap support values mapped on the ML tree) were visualized in FigTree 1.3.1. The alignment then analyzed with Maximum Parsimony (MP) and Bayesian inference (BI). MP analyses were conducted using

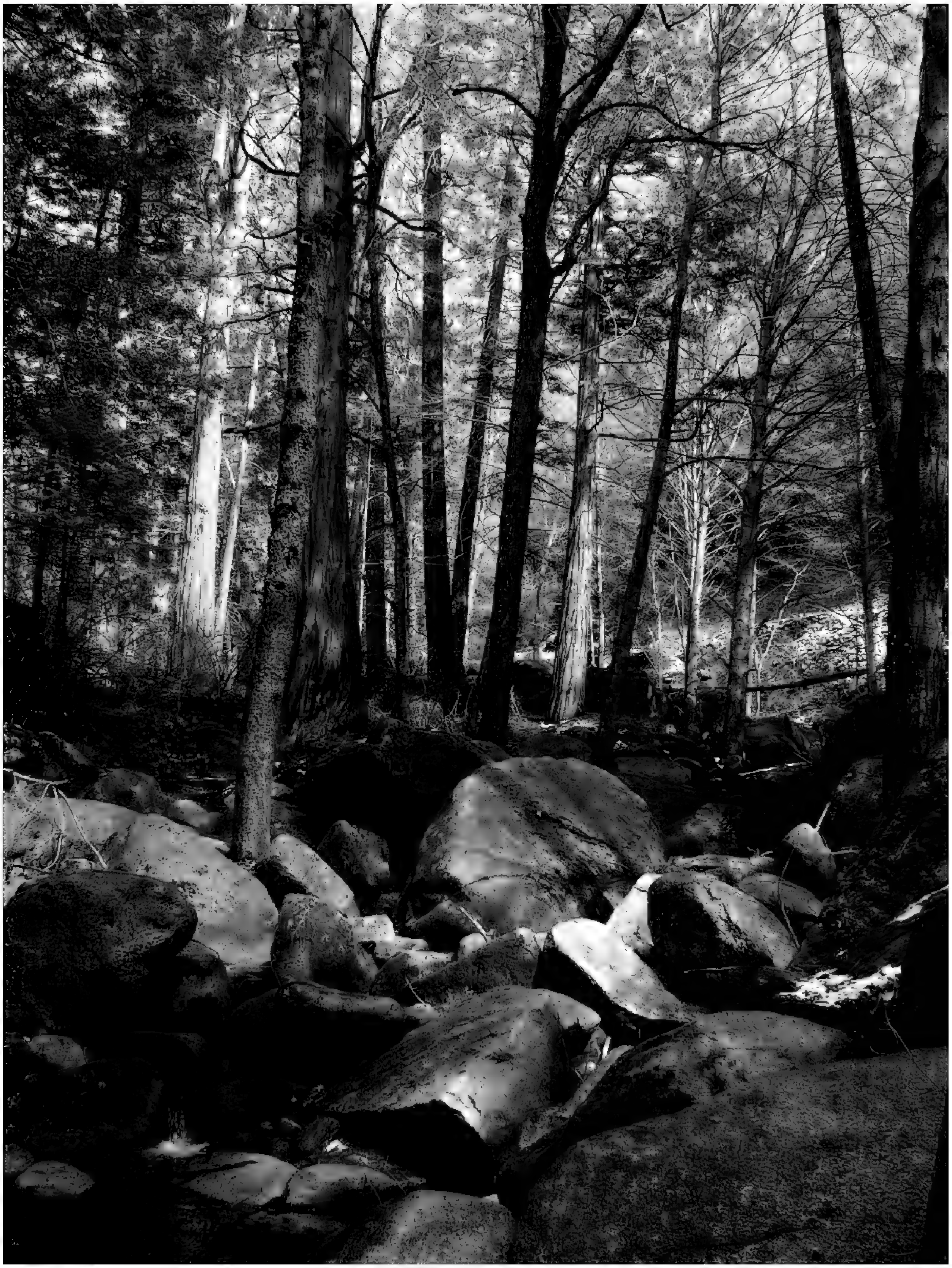

Figure 7. Important vegetation types in the study area: conifer-oak woodlands (photo from the San Bernardino Mountains).

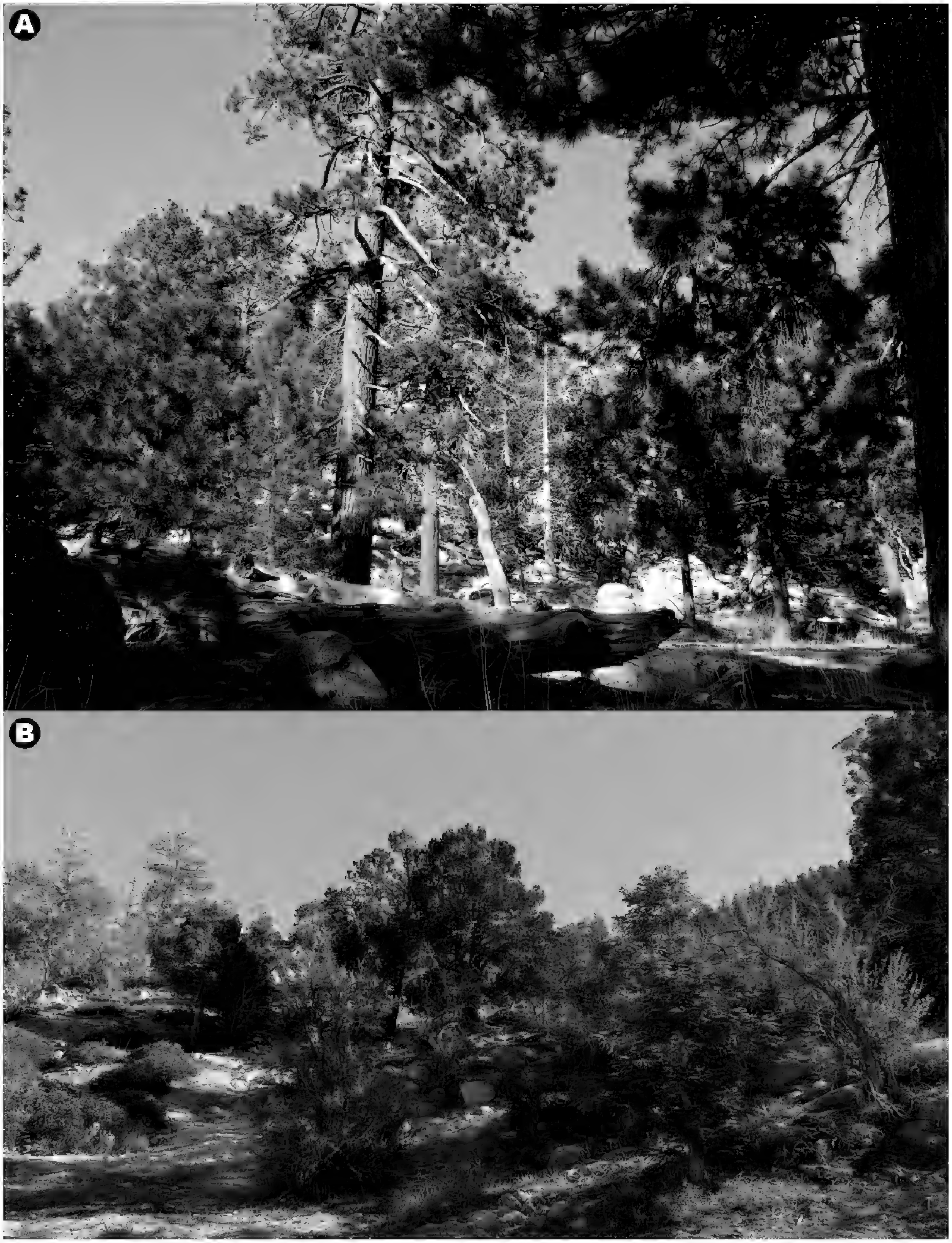

Figure 8. Important vegetation types in the study area: conifer forests and woodlands. **A,** conifer forest (photo from the San Bernardino Mountains). **B,** pinyon-juniper woodland (photo from the San Bernardino Mountains, Mojave Desert interface).

PAUP* 4.0a313 on a version of the dataset with ambiguously aligned regions excluded. An initial search was made with 1000 random-addition-sequence (RAS) replicates and tree bisection reconnection (TBR) branch swapping. The MULTREES option was in effect and zero-length branches were collapsed. All equally most parsimonious trees were saved with branch lengths, and a strict consensus tree was computed for reference. In this analysis the best tree island was hit in 100% of the replicates, and three equally most parsimonious trees were recovered. Branch support for MP trees was estimated with bootstrap analyses by performing 1000 bootstrap replicates with five RAS per bootstrap replicate, with all other settings as above. The results of these analyses were visualized in PAUP. A majority rule consensus tree using tree weights was calculated for the bootstrap replicate and also visualized in PAUP.

For BI analyses MrModeltest (Nylander 2004) selected SYM+G as the proper model of nucleotide substitution using the Akaike Information Criterion. BI was performed using MrBayes 3.1.2 (Huelsenbeck & Ronquest 2001) and a NEXUS formatted version of the alignment. The model settings produced by MrModeltest were pasted directly into the MrBayes block. The Markov chain Monte Carlo parameters consisted of 10,000,000 generations, with four chains, and a tree sampled every 100 generations. The first 10,000 trees were discarded as burn-in and the results were summarized as a 50% majority rule consensus tree. The results of the BI analyses were visualized in FigTree. The molecular datasets used for this study are available in Dryad as doi: 10.5061/dryad.d149b.

RESULTS

The results of this study are summarized and presented in four sections below. The first is a checklist of the lichens of San Bernardino National Forest that indexes which species occur in a particular mountain range and whether those species are known only from historical (pre-1955) collections. The second section presents the descriptions of two species that are new to science and which were found as part of our research in preparing the present contribution. The third and fourth sections provide brief accounts or notes for all of the species included in the checklist based on historical records or modern records respectively.

San Bernardino NF refers to San Bernardino National Forest. SB refers San Bernardino Mountains; SJ to San Jacinto Mountains. Cismontane southern California refers to the area from the Pacific coast to the slope of the Transverse Ranges. This area includes the coastal ranges and the coastal plain. The coastal ranges refer primarily to Palomar Mountain, the Santa Ana Mountains and the Santa Monica Mountains and the numerous associated hills of the coastal plain. The desert or deserts refer to the Mojave and Sonoran Deserts in southern California. The Mojave interface refers to the eastern interior side of the San Bernardino and San Gabriel Mountains that borders the Mojave Desert. The Sonoran interface refers to the interior side of the San Jacinto Mountains and a section of San Bernardino Mountains along San Gorgonio Pass that borders the Sonoran Desert. The Channel Islands refer to the eight islands off the coast of southern California. Rare means known from 3 collections or less. Infrequent, frequent, and common are subjective estimates based on experience and number of collections and attempt to give an idea of how often you might encounter a species.

PART I: INDEXED LIST OF SAN BERNARDINO NATIONAL FOREST LICHENS

*known only from historical records prior to 1955

Acarospora americana **H.Magn.** – SB, SJ
Acarospora boulderensis **H.Magn.** – SB, SJ
Acarospora brodoana **K.Knudsen, Kocourk. & M.Westb. – SB**
Acarospora elevata **H.Magn.** – SB, SJ
Acarospora epilutescens **Zahlbr.** – SJ*
Acarospora fuscata **(Schrad.) Arnold** – SB, SJ
Acarospora glaucocarpa **(Ach.) Körber** – SB
Acarospora gyrocarpa **(H.Magn.) K.Knudsen & M. Westb.** – SB
Acarospora nodulosa **(Dufour) Hue** – SJ
Acarospora obpallens **(Nyl.** ***ex*** **Hasse) Zahlbr.** – SB, SJ
Acarospora oligospora **(Nyl.) Arnold** – SJ
Acarospora oreophila **K.Knudsen** – SB, SJ
Acarospora peliscypha **Th.Fr.** – SB, SJ
Acarospora rosulata **H.Magn.** – SB, SJ, SR
Acarospora schleicheri **(Ach.) A.Massal.** – SJ
Acarospora simplex **(Taylor) Jatta** – SB, SJ
Acarospora socialis **H.Magn**. SB, SJ
Acarospora strigata **(Nyl.) Jatta** – SB, SJ
Acarospora thamnina **(Tuck.) Herre** – SB, SJ
Acarospora thelococcoides **(Nyl.) Zahlbr** – SJ
Acarospora urceolata **(Anzi) Jatta** – SB
Acarospora veronensis **A.Massal** – SB, SJ
Anaptychia ulotrichoides **(Vainio) Vainio** – SJ
Arthonia glebosa **Tuck.** – SB, SJ

Aspicilia anglica **Owe-Larsson & A.Nordin** – SB, SJ, SR
Aspicilia brucei **Owe-Larsson & A.Nordin** – SB, SJ
Aspicilia confusa **Owe-Larsson & A.Nordin** – SB
Aspicilia cuprea **Owe-Larsson & A.Nordin** – SB, SJ
Aspicilia cyanescens **Owe-Larsson & A.Nordin** – SB, SJ
Aspicilia fumosa **Owe-Larsson & A.Nordin** – SB, SJ
Aspicilia glaucopsina **(Nyl. *ex* Hasse) Hue** – SB, SJ
Aspicilia knudsenii **Owe-Larsson & A.Nordin** – SJ
Aspicilia nashii **Owe-Larsson & A.Nordin** – SB, SJ
Aspicilia olivaceobrunnea **Owe-Larsson & A.Nordin** – SB, SJ
Aspicilia peltastictoides **(Hasse) K.Knudsen & Kocourk.** – SJ*
Aspicilia phaea **Owe-Larsson & A.Nordin** – SB, SJ
Baeomyces rufus **(Huds.) Rebent** – SB
Bagliettoa calciseda **(DC.) Gueidan & Cl.Roux** – SJ
Bellemerea **sp.** – SB
Blennothallia crispa **(Huds.) Otálora, P.M.Jørg. & Wedin** – SJ
Bryoria fremontii **(Tuck.) Brodo & D.Hawksw.** – SJ
Buellia abstracta **(Nyl.) H.Olivier** – SB, SJ
Buellia badia **(Fr.) A.Massal.** – SJ
Buellia concinna **Th.Fr.** – SJ
Buellia dakotensis **H.Magn.** – SB, SJ
Buellia dispersa **A.Massal.** – SJ
Buellia erubescens **Arnold** – SB, SJ
Buellia griseovirens **(Turner & Borrer *ex* Sm.) Almb.** – SB*, SJ
Buellia imshaugii **Hafellner** – SJ
Buellia nashii **Bungartz** – SB, SJ
Buellia punctata **(Hoffm.) A.Massal.** – SB, SJ
Buellia triseptata **A.Nordin** – SB, SJ
Caeruleum heppii **(Nägeli *ex* Körber) K.Knudsen & L.Arcadia** – SJ
Calicium corynellum **(Ach.) Ach.** – SJ
Caloplaca albovariegata **(B. de Lesd.) Wetmore** – SJ
Caloplaca atroalba **(Tuck.) Zahlbr.** – SB
Caloplaca atroflava **(Turn.) Mong.** – SB, SJ
Caloplaca cerina **(Hedw.) Th.Fr.** – SB
Caloplaca chlorina **(Flot.) H.Olivier** – SJ
Caloplaca demissa **(Körber) Arup & Grube** – SB, SJ
Caloplaca diphasia **(Tuck.) Wetmore** – SB
Caloplaca isidiigera **Vězda** – SB
Caloplaca microphyllina **(Tuck.) Hasse** – SJ
Caloplaca peliophylla **(Tuck.) Zahlbr.** – SB
Caloplaca pellodella **(Nyl.) Hasse** – SB
Caloplaca saxicola **(Hoffm.) Nordin** – SB, SJ
Candelaria pacifica **M.Westb. & Arup** – SB, SJ
Candelariella aurella **(Hoffm.) Zahlbr.** – SB, SJ
Candelariella californica **M.Westb.** – SB
Candelariella citrina **B. de Lesd.** – SB, SJ
Candelariella lutella **(Vainio) Räsänen** – SB, SJ
Candelariella rosulans **(Mull.Arg.) Zahlbr.** – SB, SJ
Candelariella vitellina **(Hoffm.) Müll.Arg.** – SB, SJ
Candelariella xanthostigma **(Ach.) Lettau** – SB
Carbonea vorticosa **(Flörke) Hertel** – SB
Carbonicola anthracophila **(Nyl.) Bendiksby & Timdal** – SB, SJ, SR
Carbonicola myrmecina **(Ach.) Bendiksby & Timdal** – SB, SJ
Catapyrenium daedaleum **(Kremp.) Stein** – SB
Circinaria arida **Owe-Larsson, A.Nordin & Tibell** – SB, SJ
Circinaria contorta **(Hoffm.) A.Nordin, S.Savić & Tibell** – SB, SJ
Cladonia acuminata **(Ach.) Norrlin** – SB
Cladonia cariosa **(Ach.) Spreng.** – SB
Cladonia fimbriata **(L.) Fr.** – SB, SJ
Cladonia pulvinella **Hammer** – SB, SJ
Cladonia pyxidata **(L.) Hoffm.** – SB, SJ
Cladonia subulata **(L.) F.H.Wigg** – SB, SJ
Clavascidium lacinulatum **(Ach.) M.Prieto** – SB, SJ
Clavascidium lacinulatum **var.** *erythrostratum* **(Breuss) M.Prieto** – SJ
Collema furfuraceum **(Arnold) Du Rietz** – SB*, SJ
Cyphelium inquinans **(Sm.) Trevisan** – SB*, SJ
Cyphelium karelicum **(Vainio) Räsänen** – SJ
Cyphelium pinicola **Tibell** – SB, SJ, SR
Cyphelium tigillare **(Ach.) Ach.** – SB, SJ
Cyphelium trachylioides **(Nyl. *ex* Branth & Rostr.) Erichsen** – SJ
Dermatocarpon americanum **Vainio** – SB, SJ
Dermatocarpon miniatum **(L.) W.Mann** – SB
Dermatocarpon moulinsii **(Mont.) Zahlbr.** – SJ
Dermatocarpon reticulatum **H.Magn.** – SJ
Dermatocarpon taminium **Heidmarsson** – SB
Dimelaena lichenicola **K.Knudsen, Sheard, Kocourk. & Mayrhofer** – SB
Dimelaena oreina **(Ach.) Norman** – SB, SJ, SR
Dimelaena radiata **(Tuck.) Müll.Arg.** – SJ
Dimelaena thysanota **(Tuck.) Hale & W.L.Culb.** – SB, SJ
Diploschistes muscorum **R.Sant.** – SJ
Diploschistes scruposus **(Schreb.) Norman** – SB, SJ
Diplotomma alboatrum **(Hoffm.) Flot.** – SJ
Enchylium coccophorum **(Tuck.) Otálora, P.M.Jørg. & Wedin** – SB, SJ
Enchylium tenax **(Sw.) Gray** – SJ
Endocarpon loscosii **Mull.Arg.** – SB, SJ
Endocarpon pallidulum **(Nyl.) Nyl.** – SB
Endocarpon pusillum **Hedw.** – SJ
Evernia prunastri **(L.) Ach.** – SJ
Fulgidea sierrae **(Timdal) Bendiksby & Timdal** – SJ
Gloeoheppia rugosa **Henssen** – SJ
Gloeoheppia squamulosa **(Zahlbr.) M.Schultz** – SJ*
Gyalecta herrei **Vězda** – SJ
Gyalolechia persimilis **(Wetmore) Søchting, Frödén & Arup** – SJ
Gyalolechia subbracteata **(Nyl.) Søchting, Frödén & Arup** – SJ
Heppia adglutinata **(Kremp.) A.Massal.** – SJ
Heppia conchiloba **Zahlbr.** – SJ*
Heteroplacidium compactum **(A.Massal.) Gueidan & Cl.Roux** – SJ
Heteroplacidium zamenhofianum **(Clauz. & Cl.Roux) Gueidan & Cl.Roux** – SB
Hypocenomyce scalaris **(Ach.) M. Choisy** – SB, SJ, SR
Hypogymnia imshaugii **Krog** – SB*, SJ
Kaernefeltia merrillii **(Du Rietz) Thell & Goward** – SJ
Lathagrium fuscovirens **(With.) Otálora, P.M.Jørg. & Wedin** – SB
Lathagrium undulatum **var.** *granulosum* **Degel.** – SB
Lecania brunonis **(Tuck.) Herre** – SJ

Lecania polycycla **(Anzi) Lettau** – SB
Lecanora albellula **Nyl.** – SB, SJ
Lecanora allophana **Nyl.** – SB, SJ
Lecanora anopta **Nyl.** – SJ
Lecanora austrocalifornica **Lendemer & K.Knudsen** – SB, SJ
Lecanora cadubriae **(A.Massal.) Hedl.** – SB, SJ
Lecanora cenisia **Ach.** – SB, SJ
Lecanora chlarotera **Nyl.** – SB, SJ
Lecanora formosa **(Bagl. & Carestia) Knoph & Leuckert** – SB
Lecanora gangaleoides **Nyl.** – SB, SJ
Lecanora hybocarpa **(Tuck.) Brodo** – SJ
Lecanora laxa **(Śliwa & Wetmore) Printzen** – SB, SJ
Lecanora mellea **W.A.Weber** – SB, SJ
Lecanora munzii **K.Knudsen & Lendemer** – SB
Lecanora peninsularis **K.Knudsen, Lendemer & Elix** – SJ
Lecanora polytropa **(Hoffm.) Rabenh** – SB, SJ
Lecanora pseudistera **Nyl.** – SJ
Lecanora remota **K.Knudsen & Lendemer** – SB
Lecanora rupicola **(L.) Zahlbr.** – SB, SJ
Lecanora saligna **(Schrad.) Zahlbr.** – SB, SJ
Lecanora semitensis **(Tuck.) Zahlbr.** – SB, SJ, SR
Lecanora sierrae **B.D.Ryan & T.H.Nash** – SB, SJ, SR
Lecanora stenotropa **Nyl.** – SB, SJ
Lecanora subimmergens **Vainio** – SJ
Lecanora utahensis **H.Magn.** – SB
Lecidea atrobrunnea **(Ramond ex Lam. & DC.) Schaer.** – SB, SJ
Lecidea cascadensis **H.Magn** – SJ
Lecidea cinerata **Zahlbr.** – SJ
Lecidea diducens **Nyl.** – SB, SJ
Lecidea erythrophaea **Florke ex Sommerf.** – SB
Lecidea fuscoatra **(L.) Ach.** – SB, SJ
Lecidea hassei **Zahlbr.** – SB, SJ
Lecidea holopolia **(Tuck.) Zahlbr.** – SJ, SR
Lecidea kingmanii **(Hasse) Hertel & S.Ekman** – SB, SJ
Lecidea laboriosa **Müll.Arg.** – SB, SJ
Lecidea mannii **Tuck** – SB, SJ
Lecidea oreophila **K.Knudsen & Kocourk.** – SB, SJ
Lecidea perlatolica **Hertel & Leuckert** – SB
Lecidea protobacina **Nyl. ex Hasse** – SB, SJ
Lecidea stratura **K.Knudsen & Lendemer** – SB
Lecidea syncarpa **Zahlbr.** – SB, SJ
Lecidea tessellata **Flörke** – SB, SJ
Lecidea truckeei **Herre** – SB, SJ, SR
Lecidella asema **(Nyl.) Knoph & Hertel** – SJ
Lecidella carpathica **Körber** – SB, SJ
Lecidella euphorea **(Flörke) Hertel** – SB, SJ
Lecidella stigmatea **(Ach.) Hertel & Leuckert** – SB, SJ
Lepraria eburnea **J.R.Laundon** – SJ
Lepraria elobata **Tønsberg** – SJ
Lepraria neglecta **(Nyl.) Lettau** – SB, SJ, SR
Lepraria rigidula **(B. de Lesd.) Tønsberg** – SJ
Leprocaulon adhaerens **(K.Knudsen, Elix & Lendemer) Lendemer & B.P.Hodk.** – SB
Leprocaulon knudsenii **Lendemer & B.P.Hodk.** – SJ
Leptochidium albociliatum **(Desm.) M.Choisy** – SJ
Letharia columbiana **(Nutt.) J.W.Thomson** – SB*, SJ
Letharia lupina **Alterman, Leavitt & Goward** – SB, SJ, SR
Lichinella cribellifera **(Nyl.) P.P.Moreno & Egea** – SB
Lichinella nigritella **(Lett.) Moreno & Egea** – SB, SJ
Lobothallia alphoplaca **(Wahlenb. *ex* Ach.) Hafellner** – SB, SJ
Massalongia carnosa **(Dickson) Körber** – SB, SJ
Megaspora verrucosa **(Ach.) Hafellner & V.Wirth** – SB*, SJ
Melanelixia californica **A.Crespo & Divakar** – SB, SJ
Melanelixia subargentifera **(Nyl.) O.Blanco et al.** – SB, SJ
Melanohalea columbiana **S. Leavitt, Essl., Divakar, A.Crespo, & Lumbsch** – SJ
Melanohalea elegantula **(Zahlbr.) O.Blanco et al.** – SB, SJ
Melanohalea subolivacea **(Nyl.) O.Blanco et al.** – SB, SJ
Micarea denigrata **(Fries) Hedlund** – SB, SJ
Miriquidica scotopholis **(Tuck.) B.D.Ryan & Timdal** – SB, SJ
Montanelia disjuncta **(Erichson) Divakar, A.Crespo, Wedin & Essl.** – SB, SJ, SR
Montanelia saximontana **(R, Anderson & W.A.Weber) S. Leavitt, Essl., Divakar, A.Crespo, & Lumbsch** – SB, SJ
Myriolecis crenulata **(Hook.) Śliwa, Zhoa Xin & Lumbsch** – SB
Myriolecis dispersa **(Pers.) Śliwa, Zhoa Xin & Lumbsch** – SB, SJ
Myriolecis flowersiana **(H.Magn.) Śliwa, Zhoa Xin & Lumbsch** – SB
Myriolecis hagenii **(Ach.) Śliwa, Zhoa Xin & Lumbsch** – SJ
Myriospora scabrida **(Hedl. *ex* H.Magn.) K.Knudsen & L.Arcadia** – SJ
Naetrocymbe saxicola **(A.Massal.) R.C.Harris** – SJ
Nodobryoria abbreviata **(Müll.Arg.) Common & Brodo** – SB, SJ
Normandina pulchella **(Borrer) Nyl.** – SJ
Ochrolechia mahluensis **Räsänen** – SJ
Ochrolechia subpallescens **Verseghy** – SB
Parmelia barrenoae **Divakar, M.C.Molina & A.Crespo** – SB, SJ
Parmelia hygrophila **Ahti & Goward** – SB
Parmelia saxatilis **(L.) Ach.** – SB, SJ
Parmelina coleae **Argüello & A.Crespo** – SB, SJ
Peccania corallina **Hazsl.** – SB
Peccania cernohorskyi **(Servít) Czeika & Guttová** – SJ
Peccania tiruncula **(Nyl.) Henssen** – SJ
Peltigera collina **(Ach.) Röhl** – SB, SJ
Peltigera didactyla **(With.) J.R.Laundon** – SB*, SJ
Peltigera extenuata **(Nyl. *ex* Vain.) Lojka** – SB
Peltigera praetextata **(Flörke *ex* Sommerf.) Zopf** – SJ
Peltigera rufescens **(Weiss.) Humb.** – SB, SJ
Peltula bolanderi **(Tuck.) Wetmore** – SJ
Peltula euploca **(Ach.) Poelt *ex* Ozenda & Clauzade** – SB, SJ
Peltula michoacanensis **(B. de Lesd.) Wetmore** – SJ
Peltula obscurans **var. *hassei* (Zahlbr.) Wetmore** – SJ
Peltula obscurans **(Nyl.) Gyeln. var. *obscurans*** – SJ
Peltula omphaliza **(Nyl.) Wetmore** – SJ
Peltula patellata **(Bagl.) Swinscow & Krog** – SJ
Peltula zahlbruckneri **(Hasse) Wetmore** – SJ
Phaeophyscia ciliata **(Hoffm.) Moberg** – SB

***Phaeophyscia decolor* (Kashiw.) Essl.** – SB, SJ
***Phaeophyscia hirsuta* (Mereschk.) Essl.** – SB, SJ
***Phaeophyscia orbicularis* (Neck.) Moberg** – SB, SJ
***Phaeophyscia sciastra* (Ach.) Moberg** – SB
***Phaeorrhiza sareptana* (Tomin) H.Mayrhofer & Poelt** – SB
***Phloeopeccania pulvinulina* J. Steiner** – SB
***Phlyctis argena* (Spreng.) Flot.** – SJ
***Physcia aipolia* (Humb.) Fürnr.** – SB, SJ
***Physcia albinea* (Ach.) Moberg** – SJ
***Physcia biziana* (A.Massal) Zahlbr.** – SB, SJ
***Physcia caesia* (Hoffm.) Fürnr.** – SB, SJ
***Physcia dimidiata* (Arnold) Nyl.** – SB, SJ
***Physcia dubia* (Hoffm.) Lettau** – SB
***Physcia stellaris* (L.) Nyl.** – SB, SJ
***Physcia subalbinea* Nyl.** – SJ
***Physcia tenella* (Scop.) DC.** – SB, SJ
***Physconia americana* Essl.** – SB
***Physconia californica* Essl**. – SB, SJ
***Physconia enteroxantha* (Nyl.) Poelt** – SB, SJ
***Physconia fallax* Essl.** – SB, SJ
***Physconia isidiigera* (Zahlbr. *ex* Herre) Essl.** – SB, SJ
***Physconia leucoleiptes* (Tuck.) Essl.** – SB, SJ
***Physconia muscigena* (Ach.) Poelt** – SB, SJ
***Physconia perisidiosa* (Erichsen) Moberg** – SB, SJ
***Placidium acarosporoides* (Zahlbr.) Breuss** – SB, SJ
***Placidium californicum* Breuss** – SJ
***Placidium pilosellum* (Breuss) Breuss** – SJ
***Placidium squamulosum* (Ach.) Breuss** – SB, SJ
***Placocarpus americanus* K.Knudsen, Breuss & Kocourk.** – SB
***Placopyrenium noxium* Breuss** – SB
***Placopyrenium stanfordii* (Herre) K.Knudsen** – SJ
***Placynthiella dasaea* (Stirt.) Tønsberg** – SB
***Placynthiella icmalea* (Ach.) Coppins & P.James** – SB, SJ
***Placynthiella oligotropha* (J.R.Laundon) Coppins &P. James** – SB, SJ
***Placynthiella uliginosa* (Schrad.) Coppins & P.James** – SB, SJ
***Placynthium nigrum* (Huds.) Gray** – SJ
***Pleopsidium flavum* (Bellardi) Körber** – SB, SJ, SR
***Polycauliona luteominia* var. *bolanderi* (Tuck.) Arup, Frödén & Søchting** – SB*
***Polycauliona ignea* (Arup) Arup, Frödén & Søchting** – SB*
***Polycauliona nashii* (Nav.-Ros., Gaya & Hladún) Arup, Frödén & Søchting** – SB, SJ
***Polycauliona polycarpa* (Hoffm.) Frödén, Arup & Søchting** – SB, SJ
***Polycauliona stellata* (Wetmore & Kärnefelt) Arup, Frödén & Søchting** – SB, SJ
***Protoparmelia badia* (Hoffm.) Hafellner** – SR
***Protoparmelia ochrococca* (Nyl.) P.M.Jørg., Rambold & Hertel** – SB*
***Protoparmeliopsis muralis* (Schreb.) M.Chiosy** – SB, SJ
***Pseudephebe minuscula* (Nyl. *ex* Arnold) Brodo & D.Hawksw.** – SB
***Pseudephebe pubescens* (L.) M.Choisy** – SB, SJ
***Psora californica* Timdal** – SJ
***Psora crenata* (Taylor) Reinke** – SJ
***Psora decipiens* (Hedw.) Hoffm**. – SJ
***Psora globifera* (Ach.) A.Massal.** – SB
***Psora luridella* (Tuck.) Fink** – SJ
***Psora nipponica* (Zahlbr.) Gotth. Schneider** – SB, SJ, SR
***Psora pacifica* Timdal** – SJ
***Psora russellii* (Tuck.) A.Schneider** – SJ
***Psora tuckermanii* R.A.Anderson *ex* Timdal** – SB, SJ
***Psorotichia hassei* Fink *ex* J.Hedrick** – SB, SJ
***Psorotichia vermiculata* (Nyl.) Forssell** – SB
***Ramalina farinacea* (L.) Ach.** – SB*
***Ramalina menziesii* Taylor** – SJ*
***Ramonia ablephora* (Nyl. *ex* Hasse) R.C.Harris** – SJ
***Ramonia gyalectiformis* (Zahlbr.) Vězda** – SJ
***Ramonia vermispora* Lendemer & K.Knudsen** – SJ
***Rhizocarpon badioatrum* (Flörke) Th.Fr.** – SB
***Rhizocarpon bolanderi* (Tuck.) Herre** – SB, SJ
***Rhizocarpon dimelaenae* Timdal** – SB, SR
***Rhizocarpon disporum* (Nageli *ex* Hepp) Müll.Arg.** – SB, SJ
***Rhizocarpon distinctum* Th.Fr.** – SB
***Rhizocarpon effiguratum* (Anzi) Th.Fr.** – SR
***Rhizocarpon eupetraeum* (Nyl.) Arnold** – SB
***Rhizocarpon geminatum* Körber** – SB, SJ
***Rhizocarpon geographicum* (L.) DC.** – SB, SJ
***Rhizocarpon grande* (Flörke *ex* Flot.) Arnold** – SB, SJ
***Rhizocarpon lecanorinum* Anders** – SB
***Rhizocarpon macrosporum* Räsänen** – SB, SJ
***Rhizocarpon riparium* Räsänen** – SB, SJ
***Rhizocarpon simillimum* (Anzi) Lettau** – SB
***Rhizoplaca chrysoleuca* (Sm.) Zopf** – SB, SJ
***Rhizoplaca glaucophana* (Nyl. *ex* Hasse) W.A.Weber** – SJ
***Rhizoplaca melanophthalma* (DC.) Leuckert & Poelt** – SB, SJ
***Rhizoplaca subdiscrepans* (Nyl.) R.Sant.** – SR
***Rinodina badiexcipula* Sheard** – SB*
***Rinodina bischoffii* (Hepp.) A.Massal.** – SB
***Rinodina capensis* Hampe** – SB, SJ
***Rinodina endospora* Sheard** – SB
***Rinodina exigua* (Ach.) Gray** – SJ
***Rinodina freyi* H.Magn.** – SB
***Rinodina intermedia* Bagl.** – SB
***Rinodina juniperina* Sheard** – SJ
***Rinodina laevigata* (Ach.) Malme** – SB, SJ
***Rinodina lobulata* H.Mayrhofer & Sheard** – SJ
***Rinodina milvina* (Wahlenb.) Th.Fr.** – SB*
***Rinodina olivaceobrunnea* C.W.Dodge & Baker** – SB
***Rinodina oregana* H.Magn.** – SB
***Rinodina pyrina* (Ach.) Arnold** – SB
***Rinodina santae-monicae* H.Magn.** – SB, SJ
***Rinodina terrestris* Tomin** – SB
***Rinodina zwackhiana* (Kremp.) Körb.** – SB
***Rufoplaca arenaria* (Pers.) Arup, Søchting & Frödén** – SB, SJ
***Rusavskia elegans* (Link) S.Y.Kondr. & Kärnefelt** – SB, SJ
***Rusavskia sorediata* (Vain.) S.Y.Kondr. & Kärnefelt** – SB, SJ
***Sarcogyne arenosa* (Herre) Knudsen & S.M.Standley** – SJ
***Sarcogyne clavus* (DC.) Kremp.** – SB, SJ
***Sarcogyne crustacea* K.Knudsen & Kocourk.** – SJ

Sarcogyne hypophaea **Nyl.** – SB, SJ
Sarcogyne mitziae **K.Knudsen, Kocourk. & McCune** – SB
Sarcogyne novomexicana **H.Magn.** – SB, SJ
Sarcogyne plicata **H.Magn.** – SB, SJ
Sarcogyne regularis **Körber** – SB, SJ
Sarcogyne similis **H.Magn.** – SB, SJ
Sarcogyne squamosa **K.Knudsen & McCune** – SB
Scytinium **sp.** – SJ
Scytinium californicum **(Tuck.) Otálora, P.M.Jørg. & Wedin** – SB, SJ
Scytinium cellulosum **(P.M.Jørg. & Tønsberg) Otálora, P.M.Jørg. & Wedin** – SJ
Scytinium lichenoides **(L.) Otálora, P.M.Jørg. & Wedin** – SJ
Scytinium palmatum **(Huds.) Gray** – SJ
Scytinium plicatile **(Ach.) Otálora, P.M.Jørg. & Wedin** – SB
Scytinium subaridum **(P.M.Jørg. & Goward) Otálora, P.M.Jørg. & Wedin** – SJ
Solorina spongiosa **(Ach.) Anzi** – SB
Sporastatia testudinea **(Ach.) A.Massal.** – SJ, SR
Squamulea squamosa **(B. de Lesd.) Arup, Søchting & Frödén** – SJ
Squamulea subsoluta **(Nyl.) Arup, Søchting & Frödén** – SJ
Staurothele areolata **(Ach.) Lettau** – SB, SJ
Staurothele drummondii **(Tuck.) Tuck.** – SB, SJ
Staurothele fissa **(Taylor) Zwackh** – SB, SJ
Staurothele monicae **(Zahlbr.) Wetmore** – SB, SJ
Strangospora deplanata **(Almq.) Clauz. & Cl.Roux** – SJ
Strangospora microhaema **(Norman) R.A.Anderson** – SJ
Strangospora moriformis **(Ach.) Stein** – SJ
Thelocarpon hassei **B. de Lesd.** – SJ*
Thelomma ocellatum **(Körber) Tibell** – SJ
Toninia ruginosa **(Tuck.) Herre subsp.** *ruginosa* – SJ
Toninia sedifolia **(Scop.) Timdal** – SB, SJ
Toninia submexicana **B. de Lesd.** – SB*, SJ
Trapelia coarctata **(Turner** ***ex*** **Sm.) M.Choisy** – SB
Trapelia glebulosa **(Sw.) J.R.Laundon** – SB
Trapeliopsis flexuosa **(Fr.) Coppins & P.James** – SB, SJ
Trapeliopsis glaucopholis **(Nyl.** ***ex*** **Hasse) Printzen & McCune** – SB*, SR
Trapeliopsis granulosa **(Hoffm.) Lumbsch** – SB, SJ
Trapeliopsis steppica **McCune & Camacho** – SB, SJ
Trimmatothelopsis terricola **(H.Magn.) K.Knudsen & Lendemer** – SJ
Umbilicaria americana **Poelt & T.H.Nash** – SB
Umbilicaria hyperborea **(Ach.) Hoffm.** – SB, SJ
Umbilicaria phaea **Tuck.** – SB, SJ
Umbilicaria polaris **(Schol.) Zahlbr.** – SB, SJ
Umbilicaria virginis **Schaer.** – SB, SJ
Usnea cavernosa **Tuck.** – SB*
Usnea hirta **(L.) Weber** ***ex*** **F.H.Wigg.** – SB*, SJ
Usnea lapponica **Vain.** – SJ
Verrucaria aethiobola **Wahlenb.** – SB
Verrucaria bernardinensis **Breuss** – SB
Verrucaria furfuracea **(B. de Lesd.) Breuss** – SB
Verrucaria fusca **Pers.** ***ex*** **Ach.** – SJ
Verrucaria margacea **(Wahlenb.) Wahlenb.** – SJ
Verrucaria mimicrans **Servít** – SB
Verrucaria muralis **Ach.** – SJ
Verrucaria othmarii **(B. de Lesd.) K.Knudsen & L.Arcadia** – SB
Verrucaria sphaerospora **Anzi** – SB, SJ
Verrucaria turgida **Servít** – SJ
Vestergrenopsis sonomensis **(Tuck.) T.Sprib. & Muggia** – SJ
Xanthocarpia crenullatella **(Nyl.) Frödén, Arup & Søchting** – SB, SJ
Xanthomendoza fallax **(Hepp** ***ex*** **Arnold) Søchting, Kärnefelt & S.Y.Kondr.** – SB
Xanthomendoza fulva **(Hoffm.) Søchting, Kärnefelt & S.Y.Kondr.** – SB, SJ
Xanthomendoza galericulata **L.Lindblom** – SB
Xanthomendoza hasseana **(Räsänen) Søchting, Kärnefelt & S.Y.Kondr.** – SJ
Xanthomendoza mendozae **(Räsänen) S.Y.Kondr. & Kärnefelt** – SB, SJ
Xanthomendoza montana **(L.Lindblom) Søchting, Kärnefelt & S.Y.Kondr.** – SB, SJ
Xanthomendoza trachyphylla **(Tuck.) Frödén, Arup & Søchting** – SB
Xanthomendoza ulophyllodes **(Räsänen) Søchting, Kärnefelt & S.Y.Kondr.** – SJ
Xanthoparmelia coloradoënsis **(Gyeln.) Hale** – SB, SJ
Xanthoparmelia cumberlandia **(Gyeln.) Hale** – SB, SJ
Xanthoparmelia lavicola **(Gyeln.) Hale** – SB
Xanthoparmelia lineola **(E.C.Berry) Hale** – SB, SJ
Xanthoparmelia loxodes **(Nyl.) O.Blanco et al.** – SB
Xanthoparmelia maricopensis **T.H.Nash & Elix** – SJ
Xanthoparmelia mexicana **(Gyeln.) Hale** – SB, SJ
Xanthoparmelia novomexicana **(Gyeln.) Hale** – SB, SJ
Xanthoparmelia oleosa **(Elix & P.M.Armstr.) Hale** – SB, SJ
Xanthoparmelia plittii **(Gyeln.** ***ex*** **D.Dietr.) Hale** – SB, SJ
Xanthoparmelia subdecipiens **(Vain.) Hale** – SB
Xanthoparmelia subplittii **Hale** – SB
Xanthoparmelia subramigera **(Gyeln.) Hale** – SB, SJ
Xanthoparmelia verruculifera **(Nyl.) O.Blanco et al.** – SB, SJ
Xanthoparmelia weberi **(Hale) Hale** – SJ
Xanthoparmelia wyomingica **(Gyeln.) Hale** – SJ
Xylographa difformis **Vain.** – SJ

PART II: SPECIES NEW TO SCIENCE

***Lecidea stratura* K.Knudsen & Lendemer, sp. nov.**

Mycobank #818899.

DIAGNOSIS. – Similar to *Lecidea tessellata s. lato,* but differs in having a thinner, rugulose thallus, a dark, inspersed hypothecium, and always producing 2-0-methylperlatolic acid (either as a minor or major compound).

FIGURE 9.

TYPE: **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, The Pinnacles, 34°17′43.7″N 117°12′49.9″W, 1426 m, 13.xii.2013, on granite, *K. Knudsen et al. 16352* (UCR!, holotype; NY!, isotype).

DESCRIPTION. – *Thallus* crustose, epilithic, areolate to rimose-areolate, becoming scattered on rough surfaces, distinctly thin, usually 0.2–0.5 mm thick. *Prothallus* absent. Areoles irregular in shape, angular, distinctly rough, up to 2.0 mm across, but often smaller. Surface white to light gray, dull, epruinose. *Cortex* 20–50 µm thick of gelatinized unoriented hyphae, intergrading into subparaplectenchyma, inspersed with granules or not, obscure in water or K, dirty white with or without a pale brown narrow upper layer. *Algal layer* ca. 100 µm thick, continious or broken, algal cells mostly 10-17 µm in diameter. *Medulla* white, 100–300 µm thick of gelatinized hyphae, 2–3 µm in diameter, continuous with attaching and cortical hyphae, inspersed with small granules and mixed with large crystals from the substrate, I+ violet, though the chromatic reaction is usually weak and uneven. *Apothecia* black, 0.2–1.5 mm in diameter, many 1.0 mm in diameter, emerging from the center of the areole, overgrowing and reducing the areole to a narrow evanescent white collar or a thalline veil clinging to the thin margin, eventually occurring between the areoles, singular or in groups, round to angular by division, often taller than surrounding areoles. *Disc* black, flat to convex, dull, epruinose. *Thalline margin* non-existent or thin, sometimes forming a thalline veil or collar, eventually becoming excluded as the apothecia become more convex and lecideine. *Exciple* of radiate hyphae, mostly 80–100 µm thick, outer layer 40–50 µm thick, black, inner layer hyaline, hyphae mostly stout, ca. 3.0 µm in diameter. *Epihymenium* blue to blue-green or darker (in Austrian specimen), c. 10 µm tall, K-, N+violet. *Hymenium* 70–100 µm tall, hyaline, paraphyses not branched, mostly 2.0 µm wide, apices expanded 2.5–4.0 µm, some with pigment caps. *Subhymenium* 50–80 µm tall, not clearly distinguishable from the hypothecium, hyaline or dark. *Hypothecium,* 70–100 µm tall tall, pigmented dark in thick section, dirty in thin section, mottled with hyaline patches or not, partially clearing in K. *Asci* elongate-clavate, mostly 40-50 x 15-17 µm. Ascospores hyaline, simple, (8.0–)9.0(–9.5) × (3.0–)4.5(–5.5) µm, (n=40), l/b ratio mostly 2.0–2.2. *Conidiomata* not seen.

CHEMISTRY. – 2-*0*-methylperlatolic acid (minor or major) with or without confluentic acid aggregate (major or minor) detected with TLC. Spot tests: K-, C-, KC-, P-, UV+ dull blue-white.

ETYMOLOGY. – The epithet *stratura*, meaning pavement or paving, refers to the appearance of the thin white areolate thallus in the field.

DISTRIBUTION AND ECOLOGY. – *Lecidea stratura* is a montane species reported currently from 635 to 2003 meters elevation, on silicate rock, especially decaying granite and monzogranite, in western North America (Arizona, California) and Europe (Austria).

CONSERVATION STATUS. – Not threatened in California. The cluster of populations in Joshua Tree National Park is its current known center of diversity. It is known from one specimen from Europe and its current distribution in Europe is unknown.

DISCUSSION. – In western North America, *Lecidea stratura* can be confused with *L. confluens* (Weber) Ach., *L. oreophila, L. sauteri* Körber, and *L. tessellata* due to the superficial resemblances of their thalli and the production of the confluentic acid aggregate. *Lecidea stratura* is also sympatric with *L. oreophila* and *L. tessellata* in southern California.

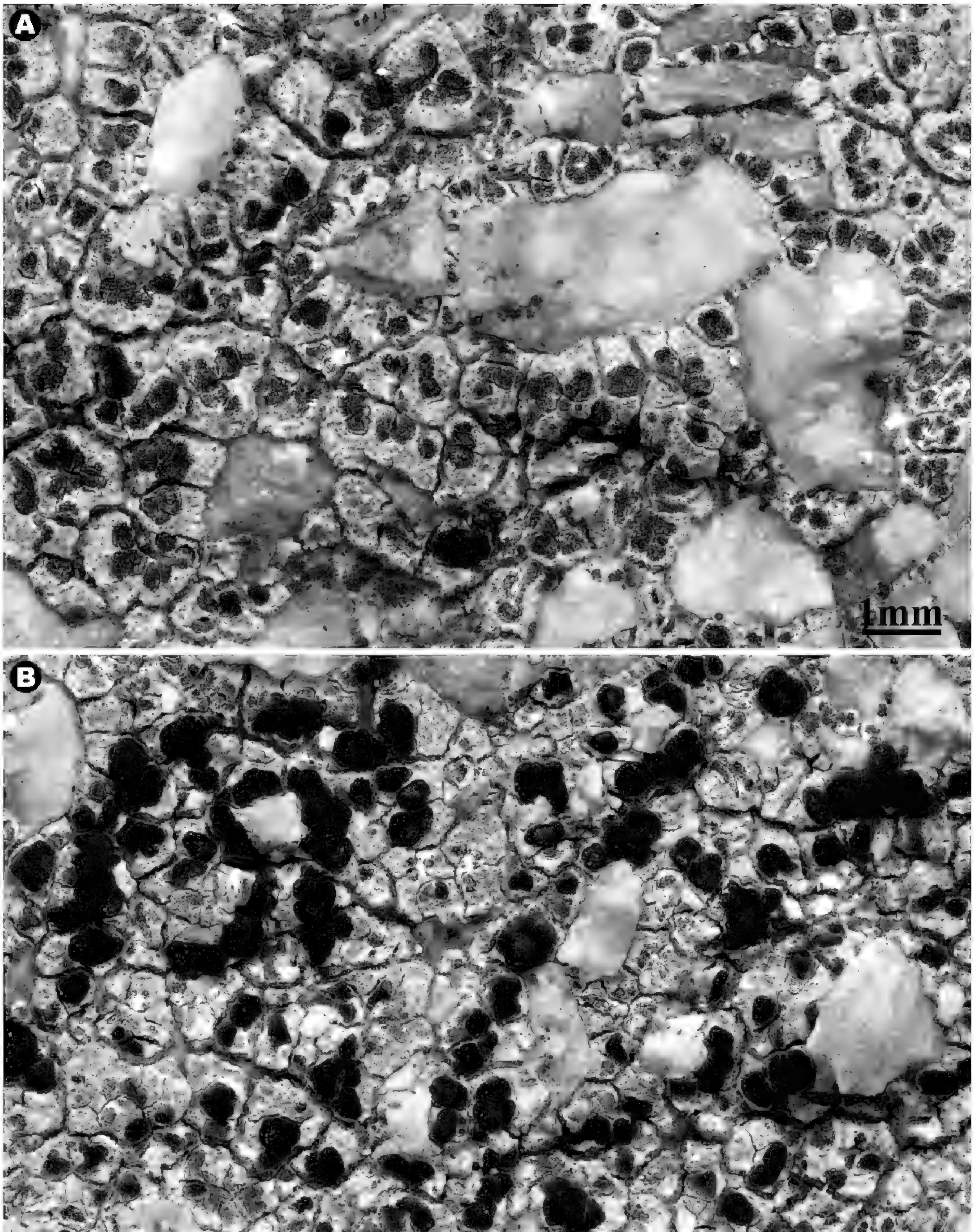

Figure 9. Morphology of *Lecidea stratura* (both from *Knudsen 16352*). **A,** portion of thallus dominated by pruinose immersed apothecia. **B,** portion of thallus dominated by sessile epruinose apothecia.

Lecidea stratura clearly differs from *L. confluens* which has a black hypothecium and a thicker cracked gray thallus (0.4–2.0 vs. 0.2–0.5 mm in *L. stratura*) with a smooth surface (for a photograph refer to Wirth et al. (2013)). *Lecidea confluens* also has longer ascospores than *L. stratura* (9.0–13.0 × 4.5–5.5 vs. 8.0–9.5 × 3.0–5.5 µm in *L. stratura*; see Knudsen & Kocourková 2014).

Like *Lecidea oreophila* the hypothecium of *L. stratura* is inspersed and dark in color (Knudsen & Kocourková 2014). *Lecidea oreophila* has an irregular gray to gray-blue rimose-areolate thallus which distinguishes it from white to light gray thallus of *L. stratura. Lecidea oreophila* always produces 2′-*0*-methylmicrophyllinic acid as a major substance, with or without confluentic acid, while *L. stratura* typically lacks that substance or only produces it in trace amounts as in the Austrian specimen examined. *Lecidea oreophila* also has larger ascospores than *L. stratura* (13 × 5.5 vs. 8.0–9.5 × 3.0–5.5 µm in *L. stratura*)

Like *Lecidea stratura*, the rare *L. sauteri* is known from Austria and western North America (San Francisco Peaks in Arizona and Wyoming) and has an inspersed hypothecium and small ascospores (Hertel 2006, Hertel & Printzen 2004). It has a thick irregular gray thallus (to 1.5 mm thick) rather than a thin white to light gray thallus like *L. stratura*, and *L. sauteri* only produces confluentic acid, never 2-*0*-methylperlatolic acid. It also has a shorter subhymenium than *L. stratura* (ca. 10 µm vs. 50–80 µm in *L. stratura*).

The differentaion of *Lecidea stratura* from *L. tessellata* is difficult because the species concept of *L. tessellata* in North American and Europe is heterogeneous and clearly consists of multiple morphological entities that appear to be correlated to broad biogeographic patterns. The thallus of *L. stratura* is white or pale gray compared to gray to blue gray thallus of *L. tessellata s. lato* (for photographs refer to Brodo et al. 2001 and Sharnoff 2014; for a description see Hertel & Printzen 2004). In the past specimens of *L. stratura* with a light gray thallus were sometimes identified as *L. tessellata*. In *L. stratura* the areoles are always thin ($\leq$0.5 mm thick) while the areoles of *L. tessellata* s. lato can be much thicker, up to 2 mm. The hypothecium of *L. tessellata* is usually hyaline, while the hypothecium of *L. stratura* is inspersed, appearing black in thick section but dirty or mottled in thin section. Unlike the other species that are externally similar to the new taxon, *L. tessellata* s. lato and *L. stratura* have overlapping ascospore ranges.

Selected specimens examined. – **AUSTRIA. STEIERMARK:** Eisenerzer Alpen, Dürrenschöberi N von Rottenmann, NW-seitig knap punter dem Gipfel**,** 47°21′50″N 14°21′50″E, 1730 m, 2.x.1999, on acid rock, *J. Hafellner 49249* (GZU). **U.S.A. ARIZONA.** Yavapai Co.: 13 s of Sedona, FS Road 618 at crossing at Red Tank, 34°40.723′N 111°43.393′W, 1158 m, 12.vi.2013, on sandstone, *D. Thornburg 1056* (NY). **CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, Zuma Ridge, 34°04′06″N 118°50′00″W, 661 m, S-side of sandstone outcrop, 31.i.2004, on sandstone, *K. Knudsen 803 & T. Sagar* (UCR). RIVERSIDE CO.: Joshua Tree National Park, Berdoo Canyon, 33°50′37″N 116°03′45″W, 1202 m, 13.xi.2011, on granite, *K. Knudsen 14196 & J. Kocourková* (UCR); Joshua Tree National Park, Dillon Rd., 33°51′N 116°03′40″W, 1352 m, 13.xi.2011, on granite, *K. Knudsen 14150 & J. Kocourková* (UCR); Joshua Tree National Park, Eureka Peak, 34°01′57″N 116°21′01″W, 1677 m, 22.viii.2005, on granite, *K. Knudsen et al. 3585* (UCR); Joshua Tree National Park, Hexie Mountains, 33°05′28″N 116°01′08″W, 1037 m, 20.xi.2012, on monzogranite, *K. Knudsen 15151 & J. Kocourková* (UCR); Joshua Tree National Park, Hidden Valley, 34°01′14.8″N 116°10′29″W, 1233 m, 9.xi.2011, on monzogranite, *K. Knudsen 13955 & J. Kocourková* (UCR); Joshua Tree National Park, Juniper Flats, 33°55′59″N 116°10′36″W, 1499 m, 20.xi.2011, on granite, *K. Knudsen 14369 & J. Kocourková* (UCR)*, K. Knudsen 14372 & J. Kocourková* (UCR); Joshua Tree National Park, Lost Horse Mountains, 33°56′59″N 116°09′02″W, 1450 m, 9.xii.2010, on granite, *K. Knudsen 12954.2* (UCR); Joshua Tree National Park, Pine City, 34°02′15″N 116°04′28″W, 1374 m, 7.x.2011, on granite, *K. Knudsen 13757.1* (UCR); Joshua Tree National Park, Pushwalla, 34°02′17″N 116°06′41″W, 1390 m, 17.xi.2011, on granite, *K. Knudsen 14269 & J. Kocourková* (UCR)*, K. Knudsen 14276 & J. Kocourková* (UCR); Joshua Tree National Park, Queen Valley, 34°00′47″N 116°06′26″W, 1350 m, 19.xii.2010, on monzogranite, *K. Knudsen 13187* (UCR); Joshua Tree National Park, Ryan Mountain, 33°59′26″N 116°08′01″W, 1580 m, 21.xi.2011, on granite, *K. Knudsen 14373 & J. Kocourková* (UCR); Joshua Tree National Park, Skull Rock, 33°59′155″N 116°03′42″W, 1351 m, 20.xii.2010, on monzogranite, *K. Knudsen 13211* (UCR); San Jacinto Mountains, western slope, 33°42′05″N 116°44′34″W, 1290 m, 29.xii.2011, on granite, *K. Knudsen 14511* (UCR); Santa Ana Mountains, Santa Rosa Plateau, 635 m, 12.x.2012, on granite, *K. Knudsen 15048.2* (UCR). SAN BERNARDINO CO.: Granite Mountain, 34°47′05″N 115°40′21″W, 1588 m, 2.xii.2005, on granite, *K.*

Knudsen 4415 & S. Werth (UCR); Joshua Tree National Park, Black Rock, 34°04′15″N 116°23′23″W, 1089 m, 1.iii.2013, on granite, *K. Knudsen 15680* (NY, UCR), Joshua Tree National Park, Lower Covington Flats, 34°01′01″N 116°17′32″W, 1379 m, 10.xi.2011, on granite, *K. Knudsen 14057 & J. Kocourková* (UCR); Joshua Tree National Park, Upper Covington Flats, 34°00′51″N 116°18′08″W, 1426 m, 9.xi.2011, on granite, *K. Knudsen 14045.1 & J. Kocourková* (UCR), Joshua Tree National Park, e/o Quail Mountain, 34°01′25″N 116°13′10″W, 1313 m, 1.iii.2012, on granite, *K. Knudsen et al. 14613* (UCR); San Bernardino Mountains, pinyon pines above Highway 18, 34°17′49″N 116°48′05″W, 2003 m, 8.vi.2014, on granite, *K. Knudsen 16832* (UCR), *K. Knudsen16834* (UCR). SAN DIEGO CO.: Warner Hot Springs, Ken Capp Foundation, 33°22′16″N 116°44′16″W, 977 m, locally common on shaded granite, 17.ii.2013, *K. Knudsen 15670 & K. Capp* (UCR).

***Lecanora remota* K.Knudsen & Lendemer, sp. nov.**

Mycobank #818900.

FIGURE 11.

DIAGNOSIS. – Similar to *Lecanora conizaeoides*, but differing morphologically in the thallus composed of dull, minute areoles with erumpent discrete soralia that contain fine soredia (vs. usually shiny, coarse areoles from which irregularly shaped soralia form that contain coarse, granular soredia), allopatric distribution in montane southern California (vs. Europe, with probably introduced populations occurring in disturbed urban and suburban locations in coastal eastern and western North America as well as the Great Lakes), and numerous nucleotide substitutions in ITS1 (compared to AF189717) including thymine instead of cytosine (positions 40, 71, 106, 117,153, 156, 163, 166 and 196), adenine instead of thymine (positions 48 and 103), cytosine instead of guanine (position 93), cytosine instead of thymine (positions 122, 151 and 160), thymine instead of guanine (position 135), guanine instead of adenine (position 164) and adenine instead of cytosine (position 174).

TYPE: **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Glass Rd., east fork of Barton Creek, 34°10′23″N 116°53′31.4″W, 1845 m, 12.vii.2015, on *Calocedrus decurrens*, *K. Knudsen 17530.2* (UCR, holotype; NY, SBBG, UPS, isotype).

DESCRIPTION. – Thallus crustose, sorediate, thin, green-gray to brown-gray in color, areolate with the areoles dispersed and separated; *hyphae* hyaline, thick walled, septate, branching, [2.0] – (2.9)–3.7–(4.5)–[5.4] µm wide (*n*=43); *prothallus* typically indistinct, immersed in the substrate and visible only as a shiny or whitish stain between the areoles; *areoles* dull, poorly developed, convex to plane, 0.05–0.1 mm in diameter; *soralia* erumpent, ca. 0.25–5.0 mm in diameter, initially +/- circular and regular in shape, sometimes merging and giving the appearance of a leprose crust; *soredia* fine, [16] – (20.3) –24.7–(29.1) – [37] µm in diameter (*n*=100), green-gray to brown-gray, turning yellowish with age in the herbarium, discrete and retained within the soralia, but sometimes spilling outwards and dispersing across the surface of the thallus so as to give the false impression of a leprose crust composed of granules; *apothecia* rare, lecanorine, poorly developed, no ascospores seen, with esorediate thalline margins and waxy yellow-brown discs. *Photobiont* coccoid, green, cells globose, [10] – (10.8)–13.4–(15.9)–[23]) µm (*n*=46) µm in diameter.

CHEMISTRY. – Fumaprotocetraric acid. Spot tests: K- or K+ dirty yellowish-brown, C-, KC-, P+ red, UV-.

ETYMOLOGY. – The name refers to the pattern of scattered green thalli of semi-discreet granules on conifer wood or bark. It is a diagnostic character in the field especially on the reddish wood of *Calocedrus decurrens*.

DISTRIBUTION AND ECOLOGY. – The species grows on the reddish wood of *Calocedrus decurrens* or the old gray mature bark of *Pinus jeffreyi* in conifer and conifer-oak forests between the elevations of 1402 ad1845 meters in the mountains of southern California (Cuyamaca Mountains, Palomar Mountain, San Bernardino Mountains).

CONSERVATION STATUS. – Rare and known only from three widely separated locations. Susceptible to extirpation by frequent or catastrophic fires.

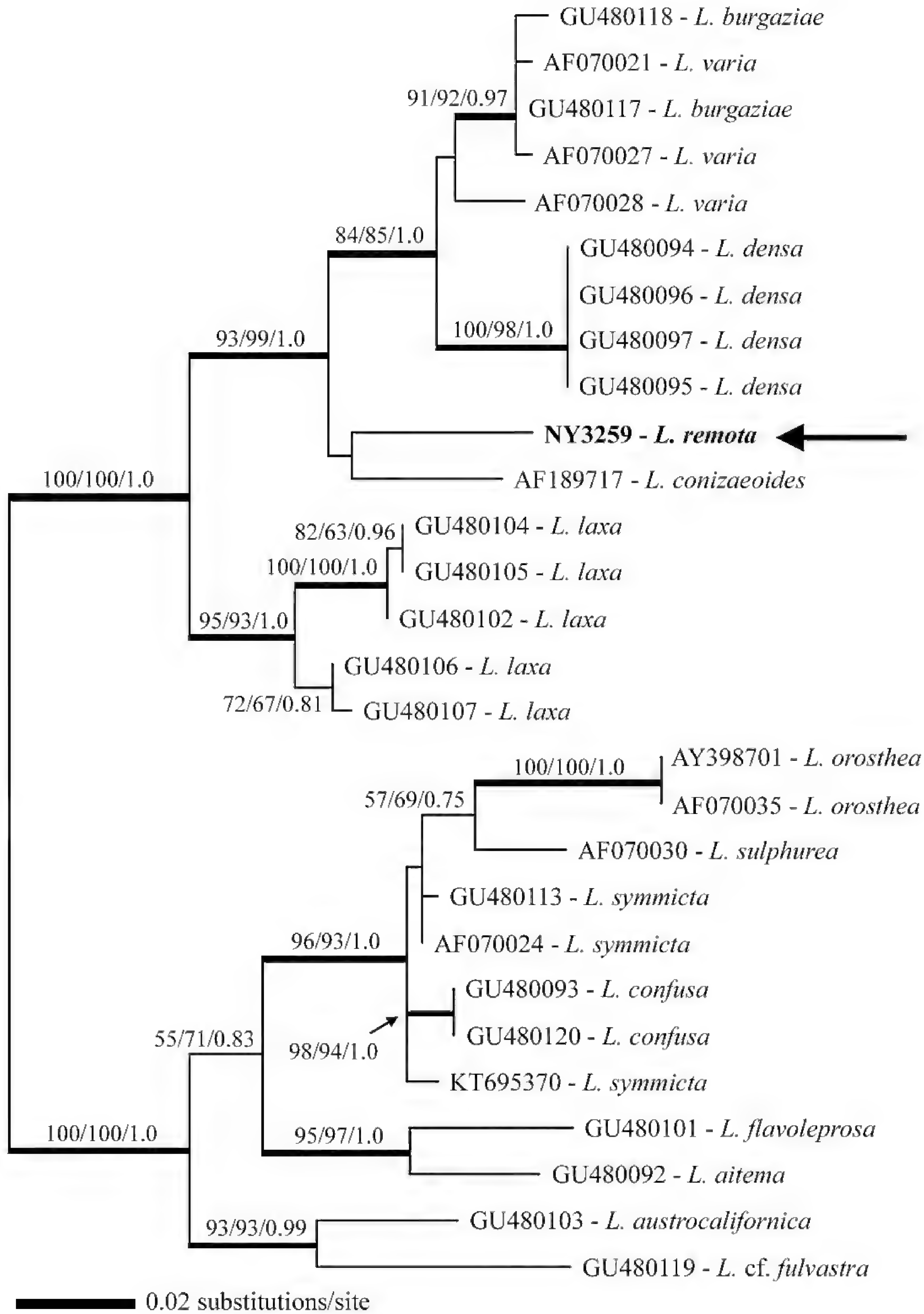

Figure 10. Phylogeny of the *Lecanora varia* group with the *L. symmicta* selected as outgroup following Pérez-Ortega et al. (2010), inferred from nrIT sequence data, and displayed as the most likely tree. Branch support evaluated as maximum likelihood bootstrap proportions (ML-BP), maximum parsimony bootstrap proportions (MP-BP) and Bayesian inference posterior probabilities (B-PP) is presented as ML-BP/MP-BP/B-PP. Thickened branches are those with ML-BP and MP-BP support ≥70 and B-PP ≥ 0.95. The newly generated sequence of *L. remota* is indicated by bold text and a large arrow.

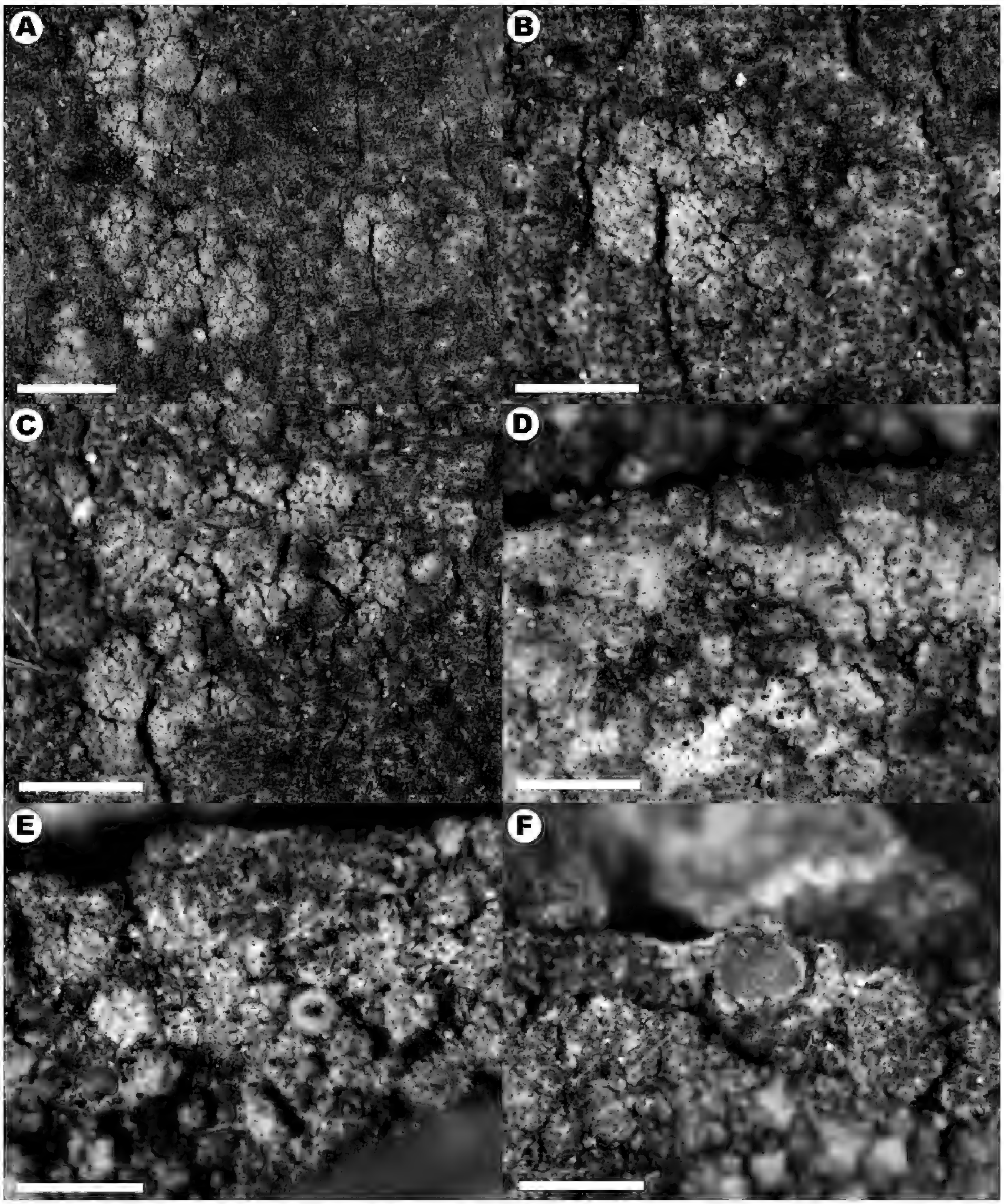

Figure 11. Morphology of *Lecanora remota* (A-C from *Knudsen 17530.2*; D-F from *Knudsen 9205*). **A,** gross morphology of the thallus. **B,** detail of thallus illustrating dull, minute areoles with discrete erumpent soralia and fine soredia. **C,** detail of thallus illustrating further progression from "B" wherein soralia expand and merge to give the sppearance of a leprose crust. **D,** older specimen illustrating typical color after storage in herbarium. **E** and **F**, apothecia associated with typical dull thallus of minute areoles with discrete soralia. Scales = 2.0 mm in A, 1.0 mm in B-F.

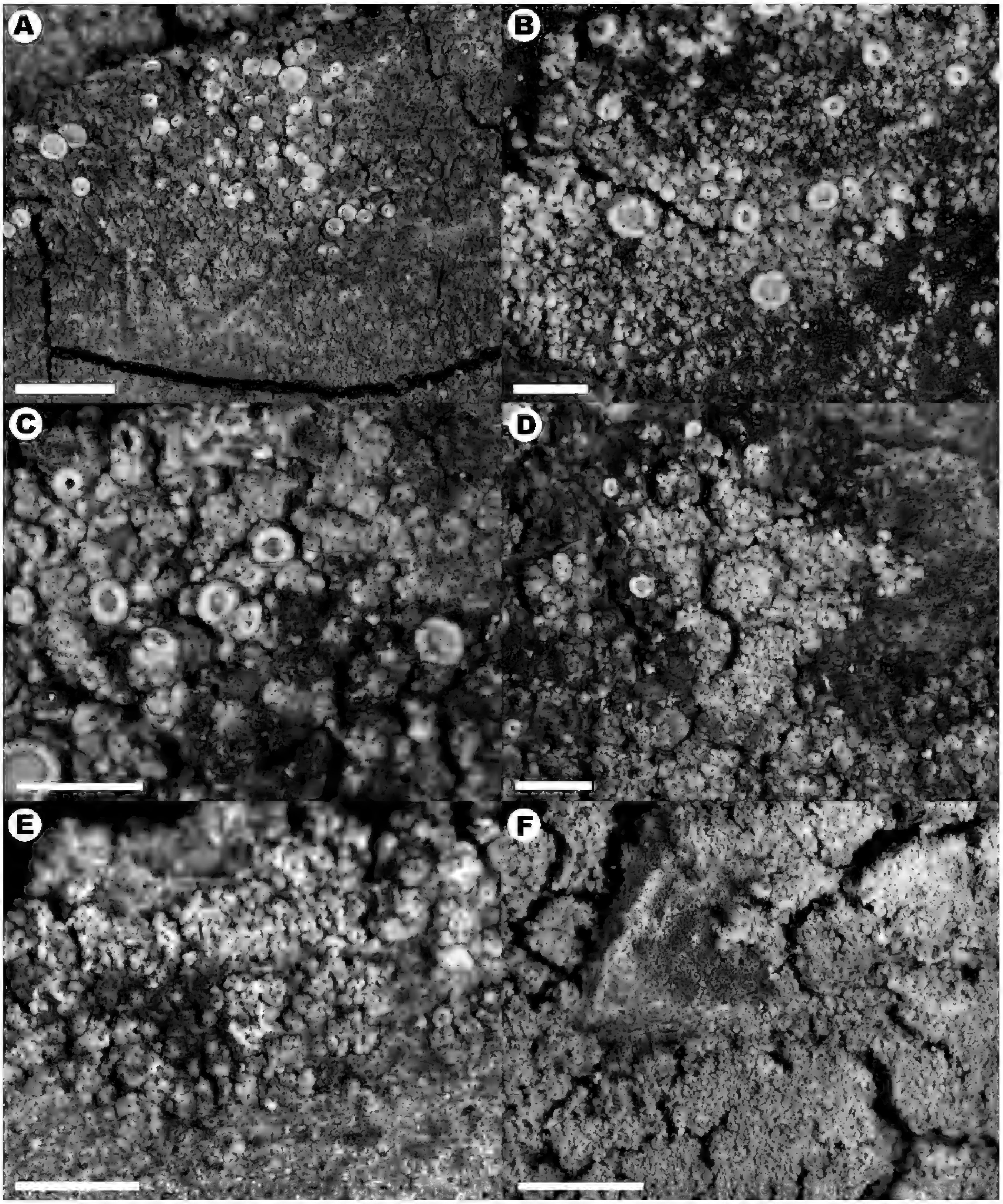

Figure 12. Morphology of *Lecanora conizaeoides* (A from *Kocourkova 7001*, B from *Kjellmert s.n.*, C from *Christiansen 6336*, D-F from *Almborn s.n.*). **A** and **B,** typical abundantly fertile thalli with coarse areoles and no soredia. **C,** detail of thallus with abundant apothecia. **D,** thallus with sparse apothecia and where the areoles have almost entirely dissolved into coarse soredia. **E,** detail of thallus with irregularly shaped soralia dissolving into coarse soredia. **F,** typical well developed sterile thallus where areoles have dissolved to form a continuous crust composed of overlapping aggregations of coarse soredia.

DISCUSSION. – *Lecanora remota* was originally considered to represent a chemotype of *Lepraria friabilis* Lendemer, K. Knudsen & Elix that was disjunct from the rest of the population of the species in southeastern North America (Lendemer et al. 2008). The material was eventually rejected as being conspecific with *L. friabilis* (Lendemer 2013a), which left this rare species without a name. Subsequently two additional locations were found, including one in the San Bernardino Mountains, material of which was sent to JCL for molecular study.

An nrITS sequence (GenBank KY490015) was successfully generated from the specimen which megaBLAST searches revealed had a close affinity to members of the *Lecanora varia* group. Molecular phylogenetic analyses of the taxon in question, together with sequences of members of the *L. symmicta* and *L. varia* groups recovered the newly generated sequence within the *L. varia* group with strong support (ML/MP/B: 100/100/1.0) in a sister relationship with the lone nrITS sequence of *Lecanora conizaeoides* available in GenBank (Figure 10). This sister relationship was not supported by any method of inference used here, and the best tree island of most parsimonious trees comprised 24 trees, eight of which recovered this relationship while the remainder recovered *L. conizaeoides* as the earliest diverging lineage within the *L. varia* clade followed by the new taxon on an isolated branch.

The molecular data presented here strongly suggest that *Lecanora remota* is not conspecific with any of the sympatric esorediate members of the *L. symmicta* and *L. varia* groups with which it occurs (e.g., *L. austrocalifornica, L. densa* and *L. laxa*; see Printzen 2001, Pérez-Ortega et al. 2010). Of those species, *L. austrocalifornica* would likely have been presumed to be most closely related to *L. remota* because it also produces fumarprotocetraric acid, although always together with usnic acid (Lendemer & Knudsen 2009). However, as we show here the two species are not even recovered as members of the same species groups. There are a several sorediate *Lecanora* species that occur in southern California and might be confused with *L. remota*, however all of those species differ chemically in the absence of fumarprotocetraric acid, the production of usnic acid, and have allopatric distributions centered in coastal habitats.

Without a doubt the most similar species to *Lecanora remota* is the European and North American sorediate taxon *L. conizaeoides* (Figure 12). In addition to the sister relationship between the two taxa recovered herein, albeit unsupported, the two species both produce soredia and fumarprotocetraric acid. *Lecanora conizaeoides* nonetheless differs in having a thallus composed of distinct, shiny areoles that erupt into irregular soralia with coarse soredia (vs. minute, dull areoles that erupt into discrete circular soralia with fine soredia). Despite being a common and widespread species in Europe (Laundon 2003), there was only one reference sequence for *L. conizaeoides* available in GenBank (AF189717). Nonetheless the Jukes-Cantor distance between that sequence and the one of *L. remota* published here is 0.0617, which is greater than that typically observed as within-species variation in lichen-forming ascomycetes (Begerow et al. 2010, Del Prado et al. 2010, Divakar et al. 2015, Lendemer 2011, Lendemer & Harris 2014) and suggests that two species level lineages are involved.

Although *Lecanora conizaeoides* is native to Europe, it has been reported from many temperate and oceanic locations in North America where it is presumed to have been introduced (Ahti 1965, LaGreca & Stutzman 2006). However, the species has not been found in drier Mediterranean areas such as southern California, and not in the montane forests where *L. remota* occurs that are far removed from urban areas. Unfortunately, further detailed of study of the morphological and molecular differences between *L. conizaeoides* and *L. remota* is precluded at this time by the small number of collections of the latter.

Additional specimens examined. – **U.S.A. CALIFORNIA.** SAN DIEGO CO.: Cuyamaca Mountains, Cuyamaca State Park, 32°59′16″N 116°34′13″W, 1409 m, 12.x.2007, on bark of single unburnt *Pinus jeffreyi*, *K. Knudsen 9205* (CANB, FH, SBBG, SDNHM, UCR). Palomar Mountain, 33°20′29″N 116°54′15″W, 1402 m, 20.iv.2005, on *Calocedrus decurrens, K. Knudsen 2790 & L. Glacy* (CANB, PRM, SDNHM).

PART III: NOTES ON SPECIES KNOWN ONLY FROM HISTORICAL RECORDS

This section summarizes the species that are known from the study area only on the basis of historical records collected prior to 1955. For descriptions of the species the reader should refer to the three volumes of the Lichen Flora of the Greater Sonoran Desert Region (Nash et al. 2002, 2004, 2007) unless otherwise stated.

***Acarospora epilutescens* Zahlbr. SJ**

NOTES. – This is a yellow *Acarospora* species whose thallus appears white when dry due to the presence of a fine pruina. The type specimen is from Palm Springs and it is known from another historical collection from Texas. When H.E. Hasse collected in beginning of 20th century, the City of Palm Springs was a small village at base of San Jacinto Mountains near Palm Canyon known for its hot springs. He often collected in the local canyons on the east slope of the San Jacinto Mountains in the Sonoran Desert. This species appears to be naturally rare and may be rediscovered eventually. For a photograph and description refer to Knudsen (2004).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, Palm Springs, no elevation or date, on granite, *H.E. Hasse s.n.* (W!, neotype designated in K. Knudsen 2004).

***Aspicilia peltastictoides* (Hasse) K.Knudsen & Kocourk. SJ**

NOTES. – This *Aspicilia* species resembles a pruinose *Acarospora.* Though we were unable to rediscover its general type locality in Palm Springs at base of San Jacinto Mountains, several specimens were recently collected in the Mojave and Sonoran Deserts in Joshua Tree National Park. Jason Hollinger recently also collected it in Nevada (Hollinger, *pers. comm.*) The species appears to be naturally rare or infrequent. For a photograph and description refer to Knudsen and Kocourková (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, Palm Springs, no elevation, 1901, on granite, *H.E. Hasse s.n.* (FH!, holotype).

***Gloeoheppia squamulosa* (Zahlbr.) M.Schultz SJ**

NOTES. – Hasse collected the type of this species in the San Jacinto Mountains at Palm Springs in crevices of disintegrating granite (Hasse 1913). It has not been recollected in the San Jacinto Mountains since that time. Modern verified collections come from Baja California and a single collection near Parker Dam along the Colorado River (Schultz 2007, CNALH 2015). It may have been at a limit of its range in Palm Springs. The number given below in the citation is not a collection number but rather a lot number in Hasse's herbarium (see Knudsen 2010). For a photohraph of the species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Palm Springs, no elevation, 1.i.1901, on yellow pine, *H.E. Hasse 822* (FH!, det. M. Schultz).

***Heppia conchiloba* Zahlbr. SJ**

NOTES. – *Heppia conchiloba* was described from soil crusts at the sandy base of the San Jacinto Mountains in Palm Springs (Hasse 1913). It was evidently already rare when Hasse collected it. He did not have a duplicate of the type in his personal herbarium and the only known specimen from the study area was the one he sent Zahlbruckner. It has not been rediscovered in its type locality, which has been transformed by development, or elsewhere in San Bernardino National Forest. *Heppia conchiloba* is rare in the Sonoran Desert in southern California. For a photograph refer to Nash et al. (2007).

No specimens examined.

***Polycauliona ignea* (Arup) Arup, Frödén & Søchting SB**

NOTES. – Clifford Wetmore annotated one historical collection made by H.E. Hasse from Mill Creek as this species. There are currently no modern collections of *P. ignea* from San Bernardino National Forest but we expect it to be rediscovered eventually. It is a common species in California but appears to be rare in study area and most frequent along the coast and on Channel Islands (Arup 1995).

Selected reference specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Mill Creek Canyon, no elevation or substrate given [probably on granite], 1.vi.1899, *H.E. Hasse s.n.* (ASU[n.v.], det. C.M. Wetmore).

***Polycauliona luteominia* var. *bolanderi* (Tuck.) Arup, Frödén & Søchting SB**

NOTES. – Clifford Wetmore annotated the historical collection made by H.E. Hasse that is cited here. This was considered a coastal taxon (Arup 1993). The first author has identified another inland collection of variety *bolanderi* from Newhall Ranch in Salt Creek Canyon in Los Angeles County (*K. Knudsen 11845*, UCR). For other examples of inland disjuncts of normally coastal species see the entries for *Dimelaena radiata* and *Psora pacifica* in Part IV below. Though generally considered a rare species, on the central coast of California, it is often abundant on serpentine, its red color especially beautiful on blue-

green serpentine. The number given below in the citation is not a collection number but rather a lot number in Hasse's herbarium (see Knudsen 2010).

Selected reference specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, no elevation or substrate given [probably on granite], 1.i.1899, *H.E. Hasse 930* (ASU[n.v.], det. C.M. Wetmore).

Protoparmelia ochrococca **(Nyl.) P.M.Jørg., Rambold & Hertel SB**

NOTES. – This species is only known in the San Bernardino Mountains from historical collections made by by H.E. Hasse in Mill Creek Canyon on wood (MIN[n.v.]) and from Pinecrest on *Calocedrus decurrens* (FH[n.v.]). This species is expected to be rediscovered. It was recently collected in Yosemite on the trunk of *Calocedrus decurrens* (Hutten et al. 2013).

Selected reference specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Pinecrest, 1676 m, viii.1912, on *Calocedrus decurrens*, *H.E. Hasse s.n.* (FH[n.v.], det. I.M. Brodo).

Ramalina farinacea **(L.) Ach. SB**

NOTES. – This species is locally abundant in southern California wherever *Ramalina* species can still be found. Robert A. Darrow collected it in the San Bernardino Mountains, where it is probably now extirpated. A general trend in the decline of *Ramalina* species has been observed in southern California by both the first author and R.F. Riefner (*pers. comm.*) who has collected *Ramalina* since the 90's, and we attribute the decline to frequent and catastrophic fires.

Selected reference specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Sawpit Canyon,1370 m, on16.vii.1933, *Abies concolor*, *R.A. Darrow 336* (PH, det. H. Kashiwadani).

Ramalina menziesii **Taylor SJ**

NOTES. – The conditions are likely too dry in the 21st century throughout most of mainland southern California for *Ramalina menziesii*. In the region populations are only currently known from the Santa Monica Mountains and the base of Palomar Mountain in San Diego (UCR 2015). These specimens are very reduced. An equally reduced specimen was collected by naturalist E. Jaeger in the San Jacinto Mountains on an oak in 1934. This is the only known collection from the San Jacinto Mountains where it is considered extirpated. It is the California State Lichen.

Selected reference specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, 1934, on *Quercus kelloggii*, *E. Jaeger s.n.* (Riverside Metropolitan Museum!)

Rinodina badiexcipula **Sheard SB**

NOTES. – This corticolous species has a scattered distribution in northern California (Sheard 2010) and occurs in Yosemite National Park (Hutten et al. 2013). Hasse collected it in the San Gabriel and the San Bernardino Mountains as well as the Santa Monica Mountains. The only modern collection from southern California was made on Palomar Mountain in San Diego County (Sheard 2010). For a description and photograph refer to Sheard (2010).

Selected reference specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 1896, *H.E. Hasse s.n.* (FH[n.v.], det. by J.W. Sheard).

Rinodina milvina **(Wahlenb.) Th.Fr. SB**

NOTES. – The saxicolous crustose lichen *Rinodina milvina* is currently known from the San Bernardino Mountains only from two collections by H.E. Hasse, one in 1899, and the one cited below from 1905 (Sheard 2010). For a photograph and description refer to Sheard (2010).

Selected reference specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 13.iii.2005, on rock, *H.E. Hasse s.n.* (ASU[n.v.], det. J.W. Sheard).

Thelocarpon hassei **B.de Lesd. SJ**

NOTES. – This species was described from a single corticolous collection by H.E. Hasse from the San Jacinto Mountains. The type was lost in the bombing of Dunkirk in World War II and no specimens are known to exist. No *Thelocarpon* species have subsequently been collected in San Bernardino National

Forest. It is possible that *T. hassei* may have been a *Strangospora* which H.E. Hasse collected in the San Jacinto Mountains and where three members of the genus are known to occur.

***Usnea cavernosa* Tuck. SB**

NOTES. – This *Usnea* sepecies was collected in the San Bernardino Mountains several times. The age of the collections suggest this species may have been extirpated by frequent or catastrophic fires, long before nitrate pollution became a problem in southern California. For photographs refer to Hinds and Hinds (2007) and Sharnoff (2014)

Selected reference specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, "Grass Valley", no elevation or date given, on *Abies concolor*, *S.B. Parish 2157* (FH[n.v.], det. J. Motyka).

PART IV: NOTES ON SPECIES KNOWN FROM MODERN RECORDS

This section summarizes the species that are known from the study area on the basis of records collected from 1955 to the present. For descriptions of the species the reader should refer to the three volumes of the Lichen Flora of the Greater Sonoran Desert Region (Nash et al. 2002, 2004, 2007) unless otherwise stated. Comments on distribution and frequency are the opinion of the authors based on their field experience and interpretation of the records in CNALH, FH, NYBG, and UCR. Earlier (i.e., pre-1955) records are usually only cited when the species was not recollected by one of the authors during the beginning of the 21st century.

***Acarospora americana* H.Magn. SB, SJ**

NOTES. – This species is common in southern California from the Channel Islands to the Mojave Desert, on usually non-calcareous substrates, and up to 2405 meters elevation in the San Bernardino Mountains. It has been collected on serpentine and on wood. It often occurs scattered among other lichens. For a description and photographs refer to Knudsen et al. (2011a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above Highway 138, W of Burnt Mill Canyon, 34°16′25"N 117°19′07"W, 1107 m, 15.xi.2015, on granite among *Lecidea fuscoatra*, *K. Knudsen 17076 & J. Kocourková* (UCR).

***Acarospora boulderensis* H.Magn. SB, SJ**

NOTES. – This species has a montane distribution in southern California where it occurrs above 1542 meters elevation on granite. It was described from Boulder, Colorado. The similar *A. badiofusca* (Nyl.) Th.Fr. has not yet been collected in southern California. For a description and photographs refer to Knudsen et al. (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Tahquitz Peak, E slope, S of trail to Tahquitz Valley, 33°45′28"N 116°40′13"W, 2605 m, 21.viii.2006, locally common on small rocks of decaying granite, *K. Knudsen 7088* (UCR).

***Acarospora brodoana* K. Knudsen, Kocourk. & M. Westb. SB**

NOTES. – This species was recently described from the San Bernardino Mountains in honor of the great North American lichenologist I.M. Brodo (Knudsen et al. 2016). It occurs on granite and schistose rock in the San Bernarrdino Mountains from 1400 to 2678 meters. It is distinguished from the similar *Acarospora gyrocarpa* especially by its dark hypothecium and higher hymenium. For a description and photographs refer to Knudsen et al. (2016).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio Wilderness Area, Dollar lake, steep terraced slope above cirque, 34°17′43.7″N 117°12′49.9″W, 2678 m, 5.vii.2012, on schistose rock, *Knudsen 14710 & J. Kocourková* (UCR, holotype; S, isotype).

***Acarospora elevata* H.Magn. SB, SJ**

NOTES. – This species was described from the San Gabriel Mountains from a collection by H.E. Hasse (Magnusson 1929). It occurs on non-calcareous rock at high elevations and is common in the Rockies. *Acarospora elevata* has an I+ blue amyloid hymenium and subhymenium, the hymenium is 65–80 µm tall and the species does not produce secondary metabolites. Montane specimens are often shiny. In

some specimens the apothecium dilates and reduces the areole to a thalline margin. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, off Morris Ranch Rd., 33°33′14"N 116°36′21"W, 1647 m, 27.v.2004, on granite rocks in pebble plain, *K. Knudsen 1992.2 & K. Kramer* (UCR).

Acarospora fuscata **(Schrad.) Arnold SB, SJ**

NOTES. – This species is common in Europe and eastern North America but is infrequent in southern California at higher elevations. It occurs on non-calcareous rock. For a photograph of material from the San Jacinto Mountains refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, north fork of San Jacinto River, 33°47′50″N 116°44′ 20″W, 1624 m, 19.iv.2004, on shaded granite boulder, *K. Knudsen 940* (UCR).

Acarospora glaucocarpa **(Ach.) Körber SB**

NOTES. – This species is frequent on limestone and dolomite in the San Bernardino Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 3N03, Smarts Ranch Rd., along seasonal stream bed, 34°15′39″N 116°43′36″W, 1961 m, 5.xi.2015, on limestone, *K. Knudsen et al. 17024* (UCR).

Acarospora gyrocarpa **(H.Magn.) K.Knudsen & M.Westb., comb. nov. SB**

MycoBank #819724.

≡ *Sarcogyne gyrocarpa* H.Magn., Acta Horti Gothob. 12: 98. 1937. ≡ *Polysporina gyrocarpa* (H.Magn.) N.S.Golubk., Konspekt Flory Lishaĭnikov Mongol'skoĭ Narodnoĭ Respubliki (Leningrad) p. 138. 1981. TYPE: **AFGHANISTAN:** Kabul area, Sher-Derwase, 1700 m, *G. Kerstain s.n.* (HAL-002585L!, lectotype (designated by Knudsen & Kocourková 2009a)).

= *Polysporina oligospora* (H.Magn.) K.Knudsen & Lendemer, Mycotaxon 93: 278. 2005. ≡ *Sarcogyne oligospora* H. Magn., Acta Horti Gothob. 19: 32. 1952. TYPE: **U.S.A. UTAH.** WAYNRE CO.: Ekker's Ranch, 1829 m, on dry red exposed sandstone, v.1951, *S. Flowers s.n.* (UPS!, holotype; COLO!, isotype).

NOTES. – This species occurs in the Mojave Desert in southern California. The species is here treated in the genus *Acarospora* because *Polysporina* is polyphylectic and this taxon is embedded in the clade of *Acarospora* (Westberg et al. 2015a). For a description refer to Knudsen and Kocourková (2009a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 2N02 crossing at Arrastre Creek, 34°15′19″N 116°44′39″W, 1959 m, 20.iii.2014, on granite boulder, *K. Knudsen et al. 16511* (UCR).

Acarospora nodulosa **(Dufour) Hue SJ**

NOTES. – *Acarospora nodulosa* was described as *A. reagens* Zahlbr. from soil crusts at the sandy base of the San Jacinto Mountains in Palm Springs (Hasse 1913). It may have been extirpated by the urban development of Palm Springs and is a rare species in southern California. The only modern collections have been made in Palm Desert (at base of San Jacinto Mountains) and on San Nicolas Island (CNALH 2015). The current synonymy of *A. reagens* with *A. nodulosa* needs further study.

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Palm Springs, no elevation or date, xi.1903, *H.E. Hasse s.n.* (FH, UCR)

Acarospora obpallens **(Nyl. *ex* Hasse) Zahlbr. SB, SJ**

NOTES. – *Acarospora obpallens* was described from a collection made by H.E. Hasse in a soil crust community near the Old Soldier's Home in Santa Monica (now a Veterans Affairs hospital complex). It occurs frequently in soil crusts in southern California as well as occasionally on non-calcareous rock. It is frequent on the western slope of the San Jacinto Mountains at low elevations, especially in soil crusts on *Selaginella* terraces. The only collection from the San Bernardino Mountains consists of sterile areoles on rock in Snow Valley. For photographs refer to Nash et al. (2007) and McCune and Rosentreter (2007).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, slope above Highway 74 and San Jacinto River, 33°42′48″N 116°46′39″W, 930 m, among *Adenostoma fasciculatum* on ridge, 11.xi.2004, in soil crust with moss, *K. Knudsen 635* (PH, UCR).

***Acarospora oligospora* (Nyl.) Arnold SJ**

NOTES. – This species produces approximately 12 to 20 large ascospores per ascus and is usually found on small stones at lower elevations in coastal southern California. In the San Jacinto Mountains it is known from a single collection made in Garner Valley. For a photograph of the species refer to Nash et al. (2007).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, hilltop in Garner Valley, 33°37′15″N 116°37′48″W, 1371 m, 28.v.2004, on consolidated granitic soil, *K. Knudsen 1196 & K. Kramer* (ASU, PH, UCR).

***Acarospora oreophila* K.Knudsen SB, SJ**

NOTES. – *Acarospora oreophila* was described from Idyllwild in the San Jacinto Mountains. It appears to be successional, occurring on granite boulders among other lichens, as the surface of the rock becomes more porous from colonization by pioneer species. For a photograph of the species refer to Nash et al. (2007).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, near Inspiration Point, 33°43′36″N 116°45′3″W, 1602 m, 4.viii.2005, on soft granite, *K. Knudsen 3459* (ASU, UCR).

***Acarospora peliscypha* Th.Fr. SB, SJ**

FIG. 13A

NOTES. – *Acarospora peliscypha* is known from California, New Mexico, and Montana (Knudsen 2007; McCune et al. 2014) and is distinguished form other members of the genus with brown thalli by having a hymenium 90–130 µm tall, production of gyrophoric acid, and apothecia with discs rugulose with sterile thalline plectenchyma. It occurs on top of San Gorgonio and is scattered in the San Bernardino National Forest. In more arid conditions in Mojave Desert it is usually sterile (Knudsen et al. 2013a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio, 34°05′00″N 116°50′11″W, 3409 m, 13.ix.2015, *A.R. Pigniolo 914.1* (UCR).

***Acarospora rosulata* H.Magn. SB, SJ, SR**

NOTES. – This species is frequent in the arid mountains of southwestern North America. It occurs near the summit of Santa Rosa Mountain. Older specimens in herbaria are often identified as *A. bullata* Anzi, which has not been found in North America. For a photograph of the species refer to Knudsen et al. (2013a) and for description refer to Knudsen et al. (2010) or Knudsen (2007, under the name *A. bullata*).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rattlesnake Canyon, 34°14′ 01″N 116°38′56″ W, 1769 m, 10.xii.2015, on granite, *K. Knudsen 17220 & M. Crawford* (UCR).

***Acarospora schleicheri* (Ach.) A.Massal. SJ**

NOTES. – This species is an obligate terricolous lichen with well-developed rhizohyphae which occurs in biotic soil crusts. It was common in the valleys of the coastal plain and at lower elevations of the coastal ranges in southern California at beginning of the 20th century but has become rare with the urban development of these areas (see e.g., Hasse 1913). It is rare in soil crusts on the western slope of the San Jacinto Mountains and in the adjacent Santa Rosa Hills above Bautista Canyon. For photographs of the species refer to Nash et al. (2007), McCune and Rosentreter (2007) and Sharnoff (2014)

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, Rouse Ridge, 33°43′06″N 116°49′17″W, 822 m, 5.x.2008, on calcareous soil in biological soil crust, *K. Knudsen 10399 & J.C. Lendemer* (UCR).

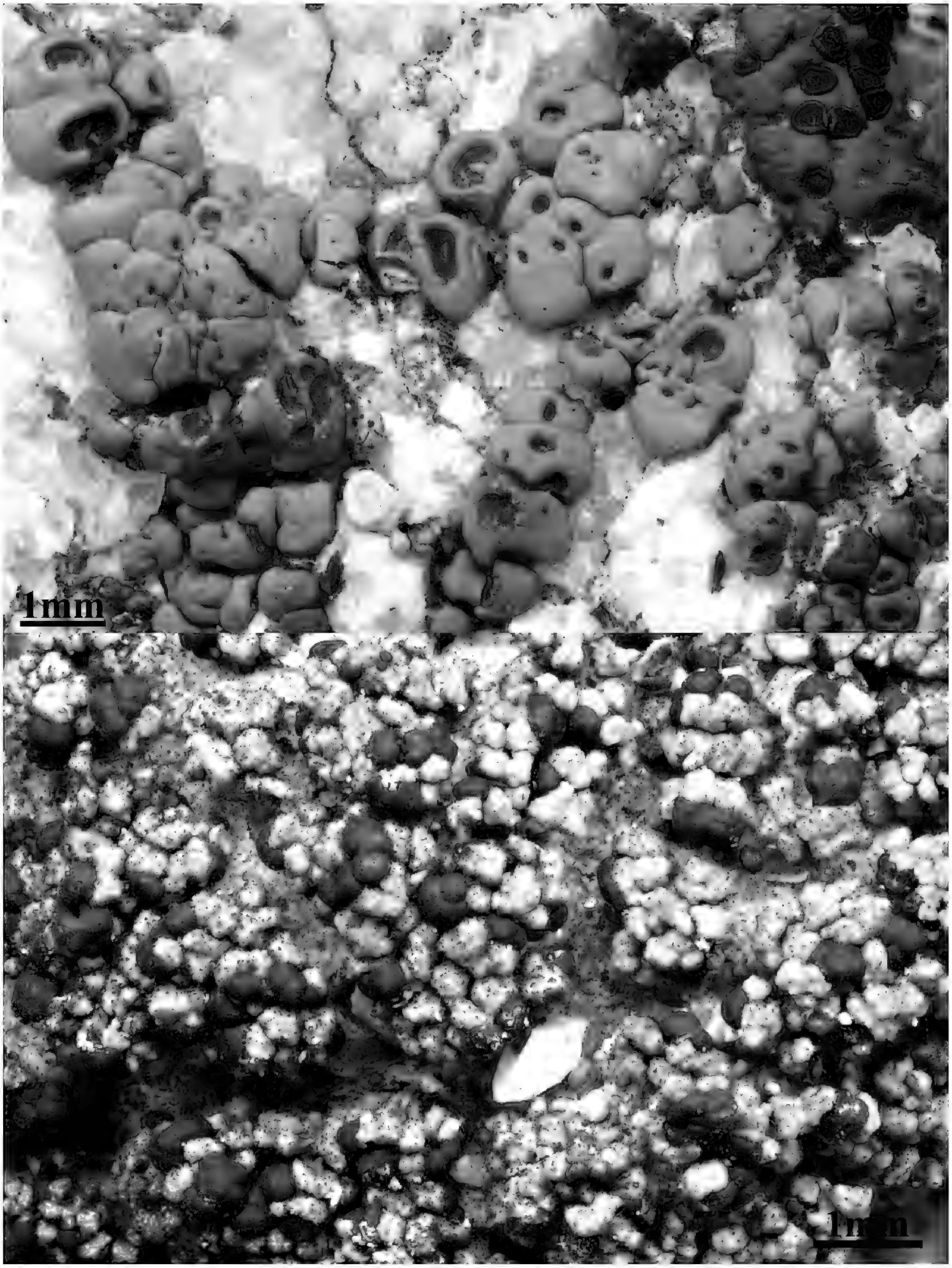

Figure 13. Photographs of selected species of San Bernardino National Forest lichens. Top: *Acarospora peliscypha* (*Pigniolo 914.1*, UCR). Bottom: *Arthonia glebosa* (*Knudsen 16358*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Acarospora simplex* (Taylor) Jatta SB, SJ**

NOTES. – This species was known as *Polysporina simplex* (Taylor) Vězda and was the type of the genus *Polysporina* Vězda. *Polysporina* was found to be polyphyletic with *P. simplex* embedded in a large *Acarospora* clade (Westberg et al. 2015a), hence we treat the species as an *Acarospora* here. It is not known yet if California specimens fall within the circumscription of *A. simplex s. str.* or if they should be referred in a wider sense and may represent an addition taxon. It is rare in San Bernardino National Forest.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, he Pinnacles, 34°18′27″N 117°12′10″W, 1419 m, 15.xi.2014, on granite, *K. Knudsen et al. 17067* (UCR).

***Acarospora socialis* H.Magn. SB, SJ**

NOTES. – This pioneer species is common throughout southern California from the islands to middle elevations in the mountains. It is especially common in the Mojave and Sonoran Deserts. It was originally described from the high central mountains of Catalina Island. For photographs of the species refrer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Jacoby Canyon, 34°18′31″N 116°50′15″W, 2093 m, 18.viii.2005, on south-facing granite rocks, *K. Knudsen 3541 & C. Wagner* (UCR).

***Acarospora strigata* H.Magn. SB, SJ**

NOTES. – *Acarospora strigata* occurs on limestone and decaying granite in San Bernardino National Forest. The specimen cited below was included in the phylogeny for the family (Westberg et al. 2015a). For photographs of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** Santa Jacinto Mountains, East Canyon, 33°39′39″N 116°35′11″W, 152 m, 10.i.2008, on calcareous rock, *K. Knudsen 9505 & J.C. Lendemer* (S, UCR).

***Acarospora thamnina* (Tuck.) Herre SB, SJ**

NOTES. – *Acarospora thamnina* is the most common *Acarospora* species in the San Bernardino National Forest occurring from about 1200 to 2500 meters in elevation, usually intermixed with other lichens on granite but easily spotted by its shiny brown squamules with very in hue. It was originally described from Mono Pass in the Sierra Nevada Mountains (Magnusson 1929). For a photograph of the species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, outcrops N of Lake Williams Rd., 34°13′49″N 116°46′54″W, 2094 m, 8.vi.2014, solitary on quartzite, *K. Knudsen 16845* (UCR).

***Acarospora thelococcoides* (Nyl.) Zahlbr. SJ**

NOTES. – *Acarospora thelococcoides* is an obligately terricolous lichen with large globose ascospores and occurrs from Baja California to central California in biotic soil crusts at low elevations. It has not been discovered on the Channel Islands. Like several other terricolous species, it is rare in San Bernardino National Forest, restricted to the western slopes of the San Jacinto Mountains at low elevations in biotic soil crusts. For photographs of the species refer to Nash et al. (2007) and Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Sant Jacinto Mountains, Rouse Ridge, 33°43′27″N 116°49′53″W, 769 m, 7.iv.2006, in biotic soil crusts, *K. Knudsen 5710* (FH, PH, UCR).

***Acarospora urceolata* (Anzi) Jatta SB**

NOTES. – This species is better known by the synonym *Polysporina urceolata* (Anzi) Brodo. *Polysporina* is polyphyletic and *P. urceolata* is embedded in a well-supported *Acarospora* clade (Westberg et al. 2015a), hence we treat the species in the genus *Acarospora* here. It is common on calcareous rock in the San Bernardino Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, narrow canyon below Silver Peak, 34°20′00″N 116°49′42″W, 1640 m, 29.xii.2013, on limestone, *K. Knudsen 16392* (UCR).

***Acarospora veronensis* A.Massal. SB, SJ**

NOTES. – This species is a small brown *Acarospora* easily confused with some morphotypes of the more common *A. americana*, which usually has a higher hymenium and more polymorphic thallus (Knudsen et al. 2011a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Bloom Flats, 34°13′15″N 116°43′41″W, 2337 m, 12.x.2015, on granite boulder, *Knudsen 17263.2 & M. Crawford* (UCR).

***Anaptychia ulotrichoides* (Vainio) Vainio SJ**

NOTES. – This species was first reported from California from the San Jacinto Mountains (Knudsen 2012). It is a small foliose lichen that grows on silicate rock and can be easily overlooked. It is rare in San Bernardino National Forest, and most North American collections are from Colorado and Montana (CNALH 2015). No new reports have been published from California. For a photograph of the species refer to Nash et al. (2002).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, Black Mountain, 33°49′28″N 116°45′31″W, 2349 m, 8.viii.2012, on side of large granite boulder, *K. Knudsen 15012* (UCR).

***Arthonia glebosa* Tuck. SB, SJ**

FIG. 13B

NOTES. –This species is frequent in biotic soil crusts in southern California from the islands to middle elevations in the San Bernardino and San Jacinto Mountains. The thallus is not as well-developed in specimens from southern California as from specimens from more northern areas in North America. For a photograph of the species refer to McCune and Rosentreter (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Pinnacles, above Trail 3W16, 34°17′45″N 117°12′53″W, 1388 m, 13.xii.2013, in soil crust among granite outcrops, *Knudsen et al. 16358.1* (UCR).

***Aspicilia anglica* Owe-Larsson & A.Nordin SB, SJ, SR**

FIG. 14A

NOTES. – This gray isidiate *Aspicilia* is often sterile. This is a montane species that was originally described based on fertile, non-isidiate specimens from California (Owe-Larsson et al. 2007). A similar species that also had a gray thallus but produced abundant isidia and was usually sterile was treated as *A.* aff. *simoënsis* in the Lichen Flora of the Greater Sonoran Desert Region (Owe-Larsson et al. 2007). Subsequent unpublished molecular work on a collection from San Jacinto Mountains has revealed that the material treated as *A.* aff. *simoënsis* is an isidiate, typically sterile form of *A. anglica* (B. Owe-Larsson, *pers. comm.*). Both forms can produce norstictic and/or substictic acid in our circumscription. The isidiate form occurs on summit of San Gorgonio. The specimen cited below corresponds to the isidiate form and was used for molecular work by Bjorn Owe-Larrson. For a photograph of the non-isidiate form of the species refer to Nash et al. (2007).

Selected specimen specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, north fork of San Jacinto River, above pool, 33°48′00″N 116°44′05″W, 1713 m, 26.vii.2008, on granite, *K. Knudsen 9996 & J. Kocourková* (UCR, UPS, isidate form with substictic acid and norstictic acid by TLC)

***Aspicilia brucei* Owe-Larsson & A.Nordin SB, SJ**

NOTES. – This *Aspicilia* has the smallest ascospores of any member of the genus which occur in San Bernardino National Forest. It was described from South Ridge in the San Jacinto Mountains (Owe-Larsson et al. 2007). While the only collection from the San Bernardino Mountains (*K. Knudsen 17301*, UCR!) is a small fragment other collections are expected. For a photograph of this species refer to Nash et al. (2007). Intereestingly it has also been recently reported from France (Roux et al. 2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, near FS 4S21, midway to Vista Point, 33°46′57″N 116°46′53″W, 1685 m, 6.x.2008, on granite boulder, *J.C. Lendemer 14684 & K. Knudsen* (NY, UCR).

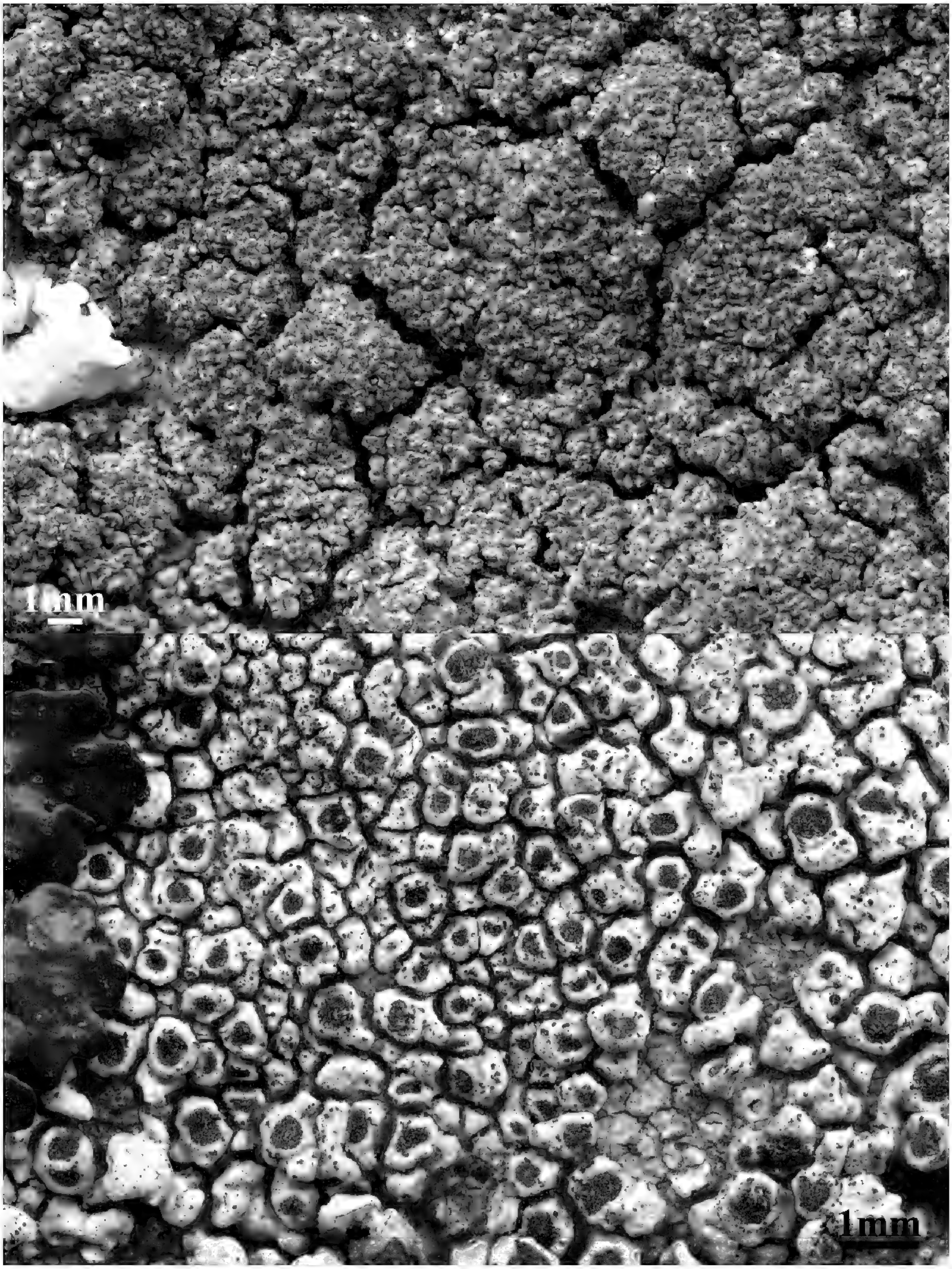

Figure 14. Photographs of selected species of San Bernardino National Forest lichens. Top: *Aspicilia anglica* (*Knudsen 17182*, UCR). Bottom: *A. fumosa* (*Knudsen 16514*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Aspicilia confusa* Owe-Larsson & A.Nordin SB**

NOTES. – This species was described from Tenaja Canyon in the Santa Ana Mountains of southern California. It has not been collected in the San Jacinto Mountains yet, but is scattered across the San Bernardino Mountains, including on Onyx Summit (*K. Knudsen 1714*, ASU, UCR). The earliest collection from the study area is from the base of the San Bernardino Mountains and was made by H.E. Hasse at Arrowhead Hot Springs in 1911 (CNALH 2015). For photographs of this species refer to Nash et al. (2007) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Arrowhead Hot Springs, 1911, *H.E. Hasse s.n.* (MIN, paratype; det. Owe-Larsson).

***Aspicilia cuprea* Owe-Larsson & A.Nordin SB, SJ**

NOTES. – The species produces the largest thalli of all *Aspicilia* species in southern California, sometimes measuring a half meter in diameter. It is also one of the most common species in southern California and in the Mojave Desert. For photographs of the species refer to Nash et al. (2007) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Bloom Flats, 34°13′15″N 116°43′41″W, 2337 m, 10.xii.2014, on granite boulder, *K. Knudsen 17062 & M. Crawford* (UCR).

***Aspicilia cyanescens* Owe-Larsson & A.Nordin SB, SJ**

NOTES. – This species was originally described from the San Jacinto Mountains where it grew on bark of a pine (*K. Knudsen 2858 & J.C. Lendemer*, UPS, holotype; ASU, isotype) and has also been collected on *Calocedrus decurrens* at Cedar Springs on Palm View Mountain (*K. Knudsen 3474*, ASU, UCR) (Owe-Larsson et al. 2007). While some of the original collections were corticolous, the species more commonly grows on granite. In the southern California mountains it is a high elevation species, usually occurring above 2000 meters elevation. The specific epithet refers to the blue-green epihymenium. For photographs of corticolous thalli of the species refer to Nash et al. (2007) and for saxicolous thalli refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Charleton Peak, 34°06′43″N 116°51′19″W, 3144 m, 6.vii.2012, on granite, *K. Knudsen 14690 & J. Kocourková* (UCR).

***Aspicilia fumosa* Owe-Larsson & A.Nordin SB, SJ**

FIG. 14B

NOTES. – *Aspicilia fumosa* has a white to gray colored thallus and was originally described from the San Jacinto Mountains. It is a rare montane species in southern California.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, Hall Canyon, along Indian Creek, UC James Reserve, 33°48′37″N 116°46′27″W, 1671 m, 13.viii.2012, on granite boulder, *K. Knudsen 15061* (UCR).

***Aspicilia glaucopsina* (Nyl. *ex* Hasse) Hue SB, SJ**

FIG. 15A

NOTES. – *Aspicilia glaucopsina* is common in biotic soil crusts in southern California where it usually occurs at lower elevations in the coastal ranges. It occurs on South Point on Santa Rosa Island together with the rare *A. praecrenata* (Nyl. ex Hasse) Hue (Knudsen & Kocourková 2012). The range of *A. glaucopsina* extends north in California through Walker Basin to the Sierra Nevada Mountains (Hutten et al. 2013). It occasionally grows on soft sandstone or disintegrating granite as is the case in the holotype collected by H.E. Hasse in the Santa Monica Mountains (Hasse 1913). It is often sterile, infected by the common lichenicolous fungus *Lichenothelia convexa* Henssen and possibly other fungi. The single collection from the San Bernardino Mountains is at its highest recorded elevation in southern California at 2098 meters in a soil crust in a pinyon-juniper woodland, well-developed and fertile, and not infected by any lichenicolous fungi.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 2N02, 34°15′14″N 116°43′18″W, 2090 m, 20.iii.2014, on fine granite-derived soil with *Placidium squamulosum*, *Knudsen et. al. 16499.1* (UCR).

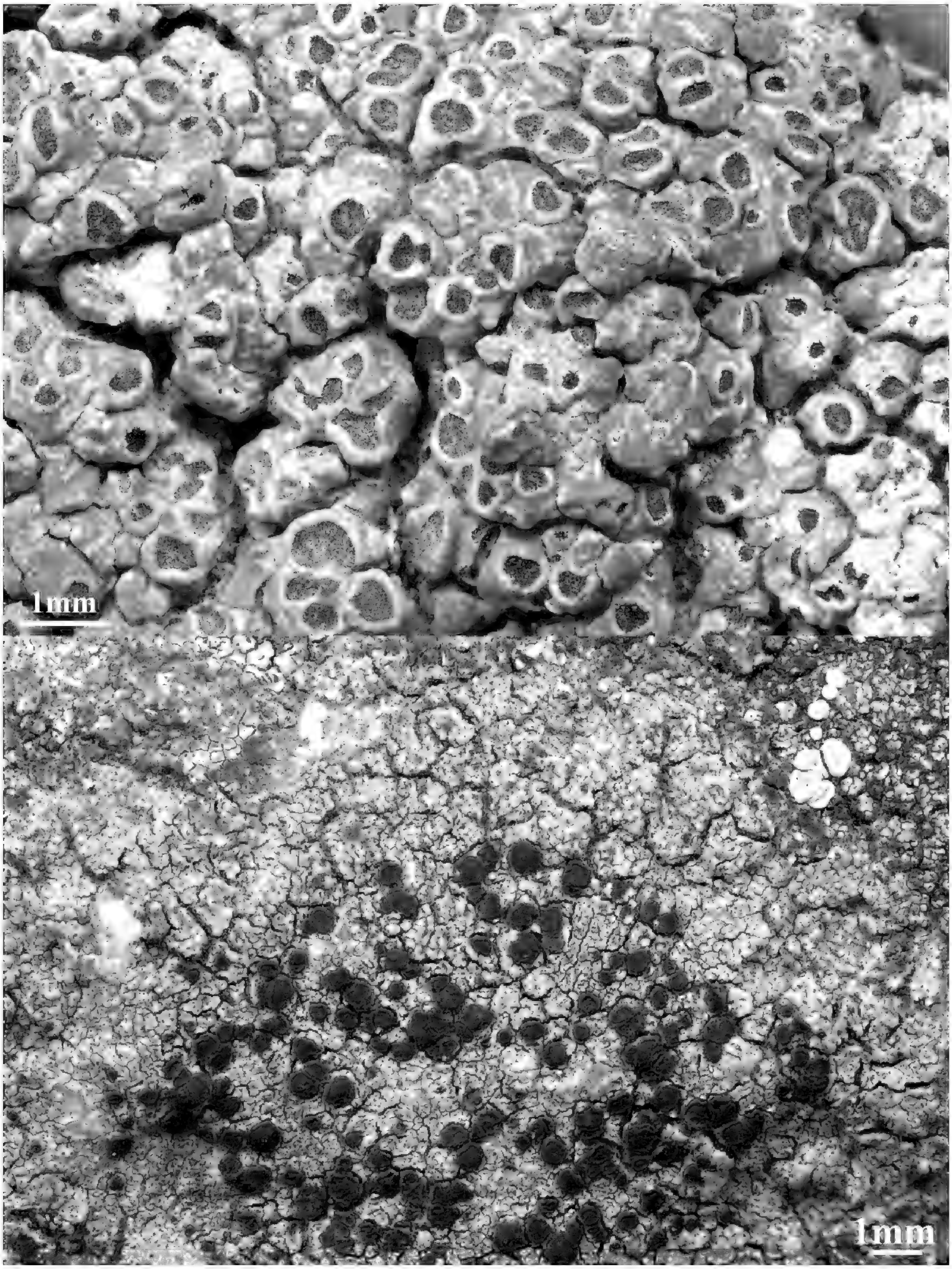

Figure 15. Photographs of selected species of San Bernardino National Forest lichens. Top: *Aspicilia glaucopsina* (*Knudsen 9348*, UCR). Bottom: *Buellia concinna* (*Sharnoff 4142*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Aspicilia knudsenii* Owe-Larsson & A.Nordin SJ**

NOTES. – *Aspicilia knudsenii* was originally described from the San Jacinto Mountains where it is rare. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, along the old Toll Road high above north fork of San Jacinto River, 33°44′11″N 116°47′38″W, 1036 m, 23.i.2004, on granite, *K. Knudsen et al. 788* (ASU, paratype).

***Aspicilia nashii* Owe-Larsson & A.Nordin SB, SJ**

NOTES. – *Aspicilia nashii* is a high elevation montane species common in Sierra Nevada Mountains but rare in the southern California mountains, with only single collections currently known from the San Jacinto and San Bernardino Mountains. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, ridge above Banning Pass, 33°51′25″N, 116°43′58″W, 2092 m, 2.x.2008, on granite, *J.C. Lendemer 14639 & K. Knudsen* (NY).

***Aspicilia olivaceobrunnea* Owe-Larsson & A.Nordin SB, SJ**

NOTES. – This species is common in Arizona but is known from only a few records from San Diego County and single records each from the San Bernardino and San Jacinto Mountains as well as the Little San Bernardino Mountains in Joshua Tree National Park (CNALH 2015; Knudsen et al. 2013a). For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, South Ridge, 33°44′10″N 116°42′07″W, 1875 m, 2.x.2008, on granite, *J.C. Lendemer 14681-B & K. Knudsen* (NY).

***Aspicilia phaea* Owe-Larsson & A.Nordin SB, SJ**

NOTES. – *Aspicilia phaea* is common in southern California. It was originally described from South Ridge in the San Jacinto Mountains (Owe-Larsson et al. 2007). For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, western slope of San Jacinto Mountains, above Highway 74, 33°41′52″N 116°45′13″W, 1229 m, 11.vii.2012, on granite rocks, *K. Knudsen 15053* (UCR).

***Baeomyces rufus* (Huds.) Rebent SB**

NOTES. – This common Holarctic species is rare in California. A population presumed to be relict from the Pleistocene was discovered in the San Bernardino Mountains, approximately 400 miles south of the populations in Marin County (Knudsen & Kocourková 2015). For illustrations and more discussion see Knudsen and Kocourková (2015). The specimen cited below is sterile and was identified based on the morphology and chemistry of the thallus.

Specimen examined. **– U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Burnt Mill Canyon, 34°16′25″N 117°19′ 07″W, 1097 m, 15.xi.2014, on soil and moss, *J. Kocourková 8564 & K. Knudsen* (hb. K & K, det. J. Kocourková).

***Bagliettoa calciseda* (DC.) Gueidan & Cl.Roux SJ**

NOTES. – This common and widespread calciphile is known from the San Jacinto Mountains from a single collection. It has not yet been found on calcareous rock in San Bernardino Mountains. For photographs see Krzewicka (2012) and Wirth et al. (2013).

Specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°42′42″N 116°49′06″W, 989 m, 5.x.2008, on calcareous rock, *J.C. Lendemer 14758 & K. Knudsen* (NY).

***Bellemerea* sp. SB**

NOTES. – A small amount of a taxon not matching the descriptions for known species was collected at Dollar Lake, a glacial cirque in the San Bernardino Mountains. It is hoped that there will be enough material for a future determination when *Bellemerea* is revised by T. Wheeler. This genus is rare in southern California and ours are the only known collections.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Dollar Lake, 34°07′22″N 116°51′1″W, 2678 m, 6.vii.2012, on schistose rock, *J. Kocourková 8148 & K. Knudsen* (UCR).

Blennothallia crispa **(Huds.) Otálora, P.M.Jørg. & Wedin SB**

NOTES. – A common and widespread species formerly known as *Collema crispum* (Huds.) Weber ex F.H.Wigg. The species occurs throughout the southwest of North America in desert soil crust communities but may also be found on calcareous rocky substrates at higher elevations.

Selected specimen examined. – **U.S.A. CALIFORNIA. SAN BERNARDINO CO.:** San Bernardino Mountains, Cactus Flat SE of junction of Rd. 18 and Smarts Ranch Rd. (FR 3N03), rocky slope, 34°18'16"N 116°47'55"W, 1860 m, 27.ix.2009, on NW-exposed marble boulders, *M. Schultz 16619d* (HBG).

Bryoria fremontii **(Tuck.) Brodo & D.Hawksw. SJ**

NOTES. – Exactly a century ago Hasse wrote that *Bryoria fremontii* was "frequent" on pines at "Keen-Allen's Camp" in the San Jacinto Mountains (Hasse 1906). We do not know where Keen-Allen Camp was. The species is probably on the verge of extirpation in the San Jacinto Mountains. Jana Kocourková discovered several branches tangled in *Letharia lupina* on Thomas Mountain across Garner Valley from main ridge of the San Jacinto Mountains, the first collection since Hasse and in an area where Hasse probably did not collect. The nearest current populations in California are in Montana de Oro State Park in San Luis Obispo County along the coast and Sequoia National Park in the inland Sierra Nevada Mountains (Hutten et al. 2013).

Selected reference specimen. – **U.S.A. CALIFORNIA**. RIVERSIDE CO.: San Jacinto Mountains, Thomas Mountain, 33°37'13.43"N 116°40'8.62"W, 2067 m, 14.xi.2016, on shady slope on wood of *Calocedrus decurrens* partly burnt long ago, *J. Kocourková 9234 & K. Knudsen* (Hb. K&K, voucher of branch tangled in *Letharia lupina*).

Buellia abstracta **(Nyl.) H.Olivier SB, SJ**

NOTES. – *Buellia abstracta* is the most common *Buellia* species on rock throughout Southern California at lower elevations. It is rare in San Bernardino National Forest. For a description of the species refer to Bungartz et al. (2007) under the name *B. sequax*. The latter name was misapplied to this taxon (Giralt et al. 2011). It occasionally occurs in biotic soil crusts. For a photograph of this species refer to Knudsen et al. (2013a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Garner Valley, along Pacific Crest Trail, 33°34′14″N 116°34′27″W, 1498 m, 21.xii. 2004, on granite rocks, *K. Knudsen 2111 & K. Kramer* (UCR).

Buellia badia **(Fr.) A.Massal. SJ**

NOTES. – *Buellia badia* begins as a juvenile parasite on a wide range of saxicolous lichens. It morphs out of the host, forming a chocolate brown independent lichenized thallus. It is common in southern California in a wide variety of habitats, especially in the coastal ranges, and on species of *Aspicilia.* In the specimen cited below the species was found growing independently on the wood of *Juniperus californica* Carr, possibly having recently grown out of *Gyalolechia persimilis*. The species is apparently rare in San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014)

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Pinyon Flats, Pinyon Flats campground, 33°35′05″N 116°27′27″W, 1217 m, 8.xi.2013, on juniper wood with *Gyalolechia persimilis*, *K. Knudsen 16317* (UCR).

Buellia concinna **Th.Fr. SJ**

FIG. 15B

NOTES. – This species is frequent on granite from Herkey Creek to the north fork of San Jacinto River in the San Jacinto Mountains and is an infrequent montane species in California (CNALH 2015).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, north fork of San Jacinto River, 33°47′47″N 116°44′22″W, 1632 m, 19.vii.2004, on granite in shade of trees *K. Knudsen 1447* (UCR).

***Buellia dakotensis* (H.Magn.) Bungartz SB, SJ**

NOTES. – This species is an infrequent member of the corticolous lichen communities on conifer bark in San Bernardino National Forest. The name *Amandinea dakotensis* (H.Magn.) P.May & J.Sheard is usually used for this taxon, but we follow Bungartz et al. (2007) and treat the species within a broadly defined concept of the genus *Buellia*. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, N-facing slope above Highway 38, 34°09′06″ N 116°56′14″W, 1771 m, 14.iii.2014, on bark of *Abies concolor*, *K. Knudsen 16484 & A. Simmons* (UCR).

***Buellia dispersa* A.Massal. SJ**

NOTES. – This is a common species in southern California at lower elevations and in the Mojave Desert in Joshua Tree National Park. It is rare in San Bernardino National Forest. For photographs of the species refer to Nash et al. (2007), Knudsen et al. (2013a) and Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, above Snow Creek (Sonoran Desert interface), 33°52′29″N 116°40′54″ W, 590 m, 15.xii.2004, on granite, *K. Knudsen 732 & K. Kramer* (SBBG, UCR).

***Buellia erubescens* Arnold SB, SJ**

NOTES. – This is an infrequent member of corticolous and lignicolous lichen communities in San Bernardino National Forest. For a photograph of this species refer to Nash et al. (2007).

Selected specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, in area between Snow Valley and Arctic Circle, 34°13′30″N 117°01′31″W, 2074 m, 11.vi.2013, on mature bark of *Abies concolor*, *K. Knudsen 15844* (UCR).

***Buellia griseovirens* (Turner & Borrer *ex* Sm.) Almb. SB, SJ**

NOTES. – This sorediate species with muriform ascospores usually occurs on conifers and is rare in the San Jacinto Mountains. It was collected by H.E. Hasse in the San Jacinto Mountains and in the San Bernardino Mountains (Allen & Lendemer 2013, Nordin 2000). It has not been collected in the San Bernardino Mountains since early in the 20th century. Further north in California, *Buellia griseovirens* is the most common sterile crust at moist low elevation sites in Yosemite National Park (Hutten et al. 2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, north fork of San Jacinto River, 33°47′50″N 116°44′ 23″W, 1576 m, 9.v.2005, on rotten wood, *K. Knudsen 2675.1 & J.C. Lendemer* (UCR).

***Buellia imshaugii* Hafellner SJ**

NOTES. – *Buellia imshaugii* begins as a juvenile parasite on *Dimelaena oreina* and develops a small gray independent thallus among the host which can easily be overlooked in the field and is often difficult to collect.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, San Jacinto State Park, trail to Round Valley, near ranger station, 33°48′45″N 116°38′36″W, 2565 m, 28.v.2013, on *Dimelaena oreina* and on granite, *K. Knudsen 15810* (UCR).

***Buellia nashii* Bungartz SB, SJ**

FIG. 16A

NOTES. – The species is infrequent and possibly under collected in California, due to its superifical similarity to other saxicolous members of the genus with well developed thalli. It is rare in the San Bernardino National Forest. For a photograph of this species refer to Nash et al. (2007).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Tahquitz Peak, 33°45′20″N 116°40′39″W, 2681 m, 21.x.2006, on granite, *K. Knudsen 7096* (FH, PH, UCR).

***Buellia punctata* (Hoffm.) A.Massal. SB, SJ**

NOTES. – *Buellia punctata* is an ecologically and morphologically variable species, and here we use the name in a broad sense for a complex of presumably closely related taxa (see Bungartz et al. 2007). *Buellia punctata* s. lato is infrequent in San Bernardino National Forest. For photographs of the species see Knudsen et al. (2013a) and Sharnoff (2014) under the name *Amandinea punctata* (Hoffm.) Coppins &

Scheid. The latter name is commonly used in the literature but we follow Bungartz et al. (2007) and treat the species within a broadly defined concept of *Buellia*.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Seven Oaks Rd., bridge over Santa Ana River, 34°11′07″N 116°53′56″W, 12.vii.2015, on *Alnus rhombifolia*, *K. Knudsen 17542* (UCR).

***Buellia triseptata* A.Nordin SB, SJ**

NOTES. – This species is an infrequent member of corticolous lichen communities on oaks and conifers in southern California (see e.g., Bungartz et. al. 2007, Nordin 1999).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Snow Valley, 34°13′10″N 117°07′20″W, 1985 m, 1.xi.2013. on mature bark of young *Abies concolor*, *K. Knudsen 15250 & J. Kocourková* (UCR).

***Careruleum heppii* (Nägeli *ex* Körber) K.Knudsen & L.Arcadia SJ**

NOTES. – This easily overlooked species is usually found on calcareous rock. It is rare in southern California.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°43′27″N 116°49′53″W, 769 m, 7.iv.2006, on calcareous rock, *K. Knudsen 5722.1* (UCR).

***Calicium corynellum* (Ach.) Ach. SJ**

NOTES. – This species has a yellow thallus, occurs on rock and in the study area is only known a single population on the North Fork of San Jacinto River in the San Jacinto Mountains. The only other known population in California is in Sequoia National Park (CNALH 2015).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°48′N 116°44′05″W, 1731 m, 28.vii.2008, on granite rocks above pool, *K. Knudsen 9992 & J. Kocourková* (NY, UCR).

***Caloplaca albovariegata* (B.de Lesd.) Wetmore SJ**

NOTES. – This species is common in the Mojave Desert in southern California, especially in the Little San Bernardino Mountains in Joshua Tree National Park (Knudsen et al. 2013a). It is frequent in desert areas of San Bernardino National Forest (Knudsen et al. 2013). For a photograph of this species refer to Knudsen et al. (2013a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: W side of San Jacinto Mountains, Bautista Canyon, 33°39′14″N 116°49′01″W, 812 m, 21.x.2004, on granite, *K. Knudsen 896.2 & K. Kramer* (UCR).

***Caloplaca atroalba* (Tuck.) Zahlbr. SB**

NOTES. – This species is frequent in the Mojave Desert. It is sometimes mistaken as a *Lecania* in its early ascospore ontogeny before the isthmus is formed. It has been collected on both granite and dolomite (UCR 2015).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rattlesnake Canyon, 34°13′51″N 116°39′36″W, 1803 m, 10.xii.2014, on granite, *K. Knudsen 17238 & M. Crawford* (UCR).

***Caloplaca atroflava* (Turner) Mong. SJ, SB**

NOTES. – This species has a scattered distribution in southern California, being most frequent on the Channel Islands. It is rare in the San Bernardino National Forest.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above Highway 138, W of Burnt Mill Canyon, 34°16′25″N 117°19′07″W, 1107 m, 15.xi.2014, on granite, *K. Knudsen 17035 & J. Kocourková* (UCR).

***Caloplaca cerina* (Ehrh. *ex* Hedw.) Th.Fr. SB**

NOTES. – This cosmopolitan species of *Caloplaca* s. str. is infrequent on oaks in southern California and rare in San Bernardino National Forest (CNALH 2015), though it is possibly undercollected. For a photograph of this species refer to Sharnoff (2014).

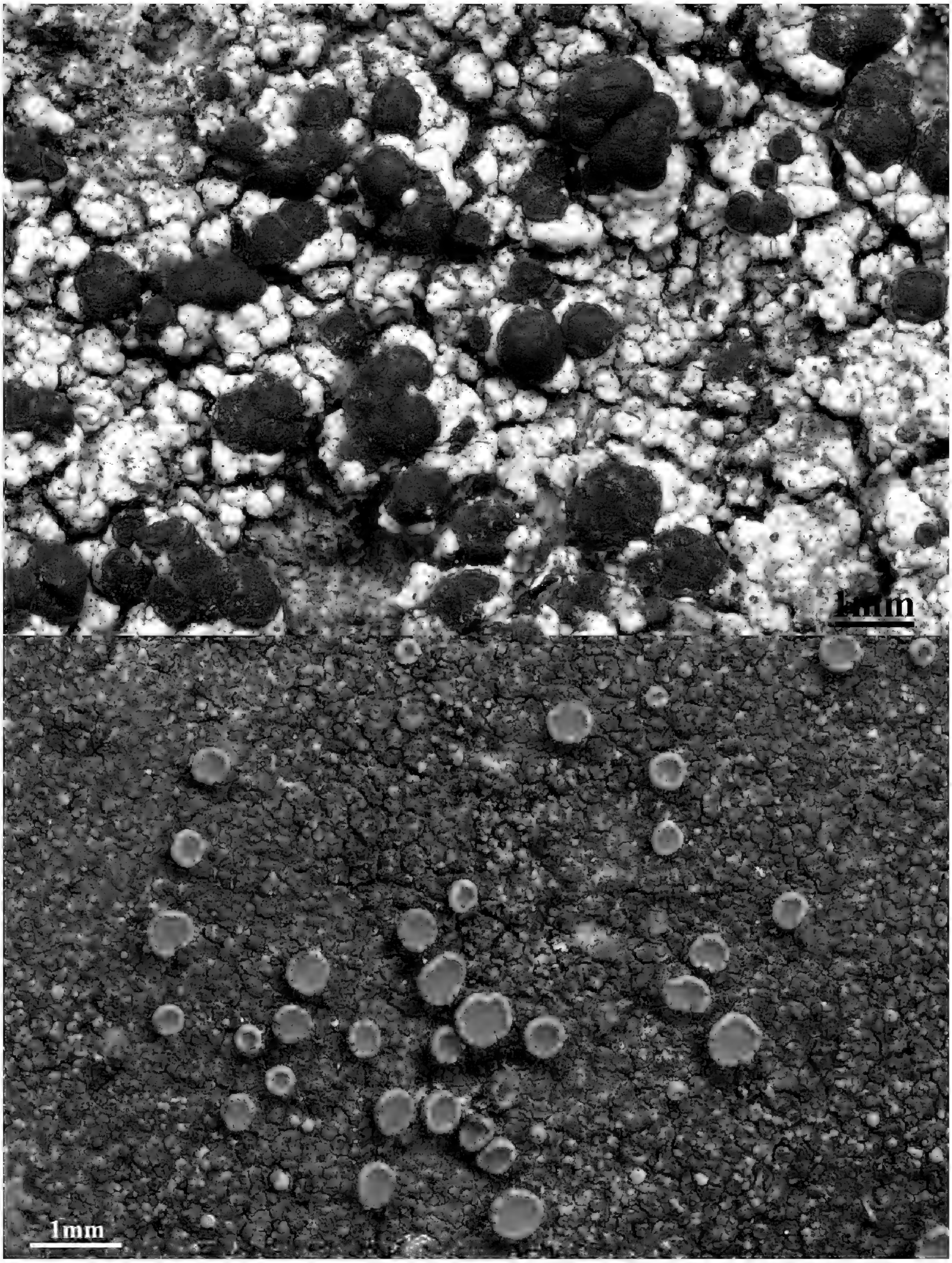

Figure 16. Photographs of selected species of San Bernardino National Forest lichens. Top: *Buellia nashii* (*Knudsen 16917*, UCR). Bottom: *Caloplaca isiidigera* from Montana (*Wheeler 3841*, hb. Wheeler). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, N-facing slope above Highway 38, 34°09′06″N 116°56′14″W, 1771 m, 14.ii.2014, on smooth *Quercus* bark, *K. Knudsen 16482 & A. Simmons* (UCR).

Caloplaca chlorina **(Flot.) H.Olivier SJ**

NOTES. – The thallus of this typically gray isidiate species was almost leprose and had one apothecium in our collection. It is rare in the study area and was found growing in crevices of a granite boulder in shade in San Jacinto State Park. It was recently reported as frequent in Yosemite (Hutten et al. 2013). For a photograph of this species refer to Wirth et al. (2013).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, San Jacinto State Park Wilderness Area, near Round Valley, 33°48′44″N 116°38′54″W, 2597 m, 3.vi.2013, in crevices of granite boulder, *K. Knudsen 15839* (LD, NY, UCR; det. U. Arup).

Caloplaca demissa **(Körber) Arup & Grube SB, SJ**

NOTES. – This sterile sorediate species has a scattered distribution in southern California and is rare in San Bernardino National Forest. Botanist and lichen collector R.E. Riefner documented it above Bautista Canyon on the west side of San Jacinto Mountains (*R.E. Riefner 90–139*, ASU[n.v.]).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Miller Canyon, 34°16′11″N 117°17′26″W, 1146 m, 15.xi.2014, on large granite boulder, *K. Knudsen 17057 & J. Kocourková* (UCR).

Caloplaca diphasia **(Tuck.) Wetmore SB**

NOTES. – *Caloplaca diphasia* has frequently been collected on twigs, branches and bark of a variety of trees at lower elevations in Mexico and Texas (CNALH 2015). The collection from the San Beranrdino Mountains is a cluster of small apothecia (0.2–0.3 mm) growing on the stems of a moss in a relictual area with much decaying wood at a high elevation of 2439 meters in an arid conifer forest. This general area also had the highest elevation reports of *Candelaria pacifica* and *Placynthiella dasea* in southern California. The substrate of moss stems is unusual for this species. *Caloplaca diphasia* is here reported new for California.

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Highway 38 and Rainbow Lane, 34°10′22″N 116°43′05″W, 2439 m, 3.xi.2013, on stems of moss, *K. Knudsen 16289 & J. Kocourková* (UCR).

Caloplaca isidiigera **Vězda SB**

FIG. 16B

NOTES. – *Caloplaca isidiigera* is here reported new for California. It was previously reported new from North America based on a collection made by T. Wheeler in Montana in front of his house and that specimen is used for the figure herein (Šoun et al. 2011; McCune et al. 2014). For a photograph of European material refer to Wirth et al. (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Rainbow Lane and Highway 38, 34°10′22″N 116°43′05″W, 2439 m, 3.xi.2014, along base of granite outcrop, *K. Knudsen 16286 & J. Kocourková* (UCR; det. U. Arup).

Caloplaca microphyllina **(Tuck.) Hasse SJ**

NOTES. – This sorediate species usually occurs on oaks in southern California at lower elevations. It is rare in San Bernardino National Forest. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, middle Rouse Ridge, 33°42′42"N, 116°43′06"W, 989 m, 5.x.2008, on wood, *J.C. Lendemer 14751-A & K. Knudsen* (NY).

Caloplaca peliophylla **(Tuck.) Zahlbr. SB**

NOTES. – This species is rare in southern California. It is known in from San Bernardino National Forest only from the Sonoran interface near Banning.

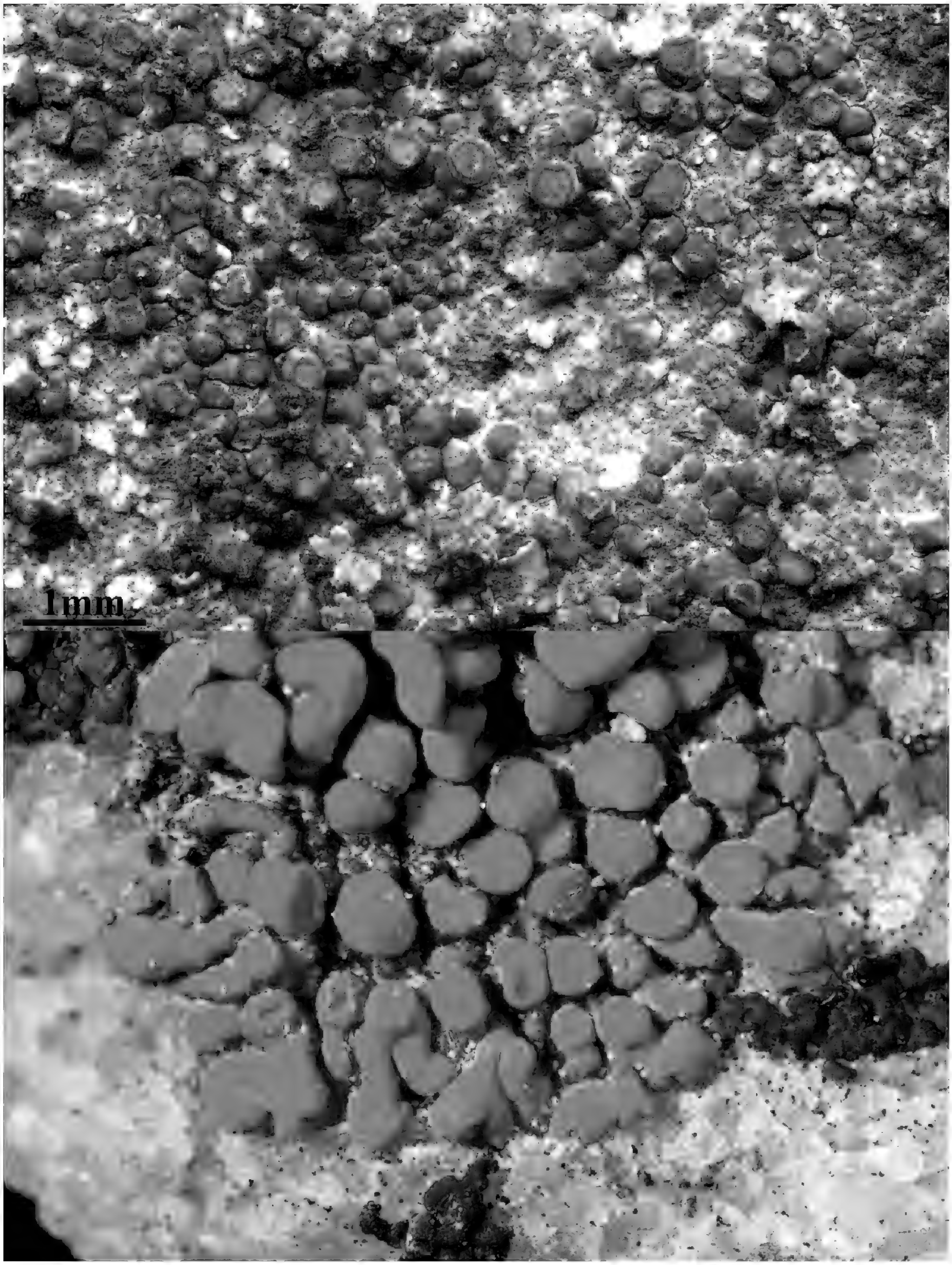

Figure 17. Photographs of selected species of San Bernardino National Forest lichens. Top: *Caloplaca pellodella* (*Harding s.n.*, UCR). Bottom: *Caloplaca saxicola* (*Knudsen 16619*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino National Forest, S of Banning, no elevation or substrate data [probably on granite], 1.i.1965, *C.M. Wetmore 14631* (ASU[n.v.]).

Caloplaca pellodella **(Nyl. *ex* Hasse) Nyl. SB**

FIG. 17A

NOTES. – This species is rare in southern California. It is known in San Bernardino National Forest only from a single collection made on the summit of San Gorgonio. The species was originally described from Lake Elsinore (Hasse 1913). For a photograph of the species refer to Nash et al. (2007).

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, summit of San Gorgonio, 34°05′57″N 116°49′29″W, 3491 m, 6.vii.2012, on granite, *M. Harding s.n.* (UCR[p.p. in same packet with *Buellia* species]; det. K. Knudsen).

Caloplaca saxicola **(Hoffm.) A.Nordin SJ, SB**

FIG. 17B

NOTES. – This species is scattered throughout San Bernardino National Forest and usually occurs on granite. For photographs of the species refer to Nash et al. (2007) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, along 1NO2, 34°15′22″N 116°42′57″W, 2068 m, 20.iii.2014, on granite, *K. Knudsen et al. 16495* (UCR).

Candelaria pacifica **M.Westb. & Arup SJ, SB**

NOTES. – This fast-growing yellow servediate species is common throughout southern California on chaparral and on trees. It sometimes grows on decorticated wood and rock. Occasionally the thallus is entirely leprose, becoming entirely dissolved into soredia. The specimen cited below comprises an example where the thallus has almost entirely dissolved into soredia, but it is abundantly fertile. The highest recorded population in southern California is from the San Bernardino Mountains at 2167 meters, an area that was burned in 2015. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above dirt road to Fish Creek, 34°08′53″N 116°46′19″W, 2167 m, 23.xi.2014, on peeling bark of *Cercocarpus ledifolius*, *K. Knudsen 17169* (UCR).

Candelariella aurella **(Hoffm.) Zahlbr. SB, SJ**

NOTES. –This yellow species often has only an endolithic thallus in southern California. It is common throughout San Bernardino National Forest on non-calcareous and calcareous rock. It was collected once on wood on the desert side of San Bernardino Mountains and even occurs on the summit of San Gorgonio. For photographs of the species refer to Nash et al. (2004) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′16″N 116°47′00″W, 1895 m, 16.ix.2004, on dolomite ledge, *Knudsen et al. 1682* (UCR).

Candelariella californica **M.Westb. SB**

NOTES. – This is a rare species with biatorine apothecia that occurs on high elevation non-calcareous rock. It occurs on the summit of San Gorgonio. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Charleton Peak, trail back to Dollar Lake, 34°06′43″N 116°51′19″W, 3144 m, 6.vii.2012, on granite, *K. Knudsen 10710.2 & J. Kocourková* (UCR).

Candelariella citrina **B.de Lesd. SB, SJ**

NOTES. – This species often has a reduced thallus in southern California, especially in the desert, and identification is based on the broad, pointed ascospores. For photographs refer to Nash et al. (2004) and Sharnoff (2014).

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Pinyon Flats, 33°35′05″N 116°26′24″W, 1238 m, 10.viii.2012, on granite, *K. Knudsen 15040* (UCR).

***Candelariella lutella* (Vainio) Räsänen SB, SJ**

NOTES. – This species with polysporous asci is infrequent in San Bernardino National Forest but may be easily overlooked in mixed corticolous communities. For a photograph of the species refer to Nash et al. (2004).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, N-facing slope above Highway 38, 34°09′06″N 116°56′10″W, 1771 m, 6.xi.2014, on *Quercus* bark, *K. Knudsen 17299 & J. Kocourková* (UCR).

***Candelariella rosulans* (Müll.Arg.) Zahlbr. SB, SJ**

NOTES. – This yellow squamulose species is often found growing among moss and other lichens on granite boulders. It also is often sterile in southern California. For photographs refer to Nash et al. (2004) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Pinnacles, 34°18′27″N 117°12′10″W, 1419 m, 15.xi.2014, on granite, *K. Knudsen 17066 & J. Kocourková* (UCR).

***Candelariella vitellina* (Hoffm.) Müll.Arg. SB, SJ**

NOTES. – This yellow species usually lacks a visible thallus in southern California and is common in San Bernardino National Forest. For a photograph of an individual with a well developed epilithic thallus refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, grade N of Onyx summit descending toward Big Bear, 34°12′11″N 116°43′38″W, 2513 m, 9.vi.2014, on granite, *K. Knudsen 16868* (UCR).

***Candelariella xanthostigma* (Ach.) Lettau SB**

NOTES. – This species is common on wood in the middle elevations of the San Bernardino Mountains. For photographs refer to Nash et al. (2004) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, head of Furnace Canyon, 34°19′30″N 116°56′02″W, 2241 m, 10.ix.2004, on dead branches of *Calocedrus decurrens, M. Elvin s.n.* (UCR; det. K. Knudsen).

***Carbonea vorticosa* (Flörke) Hertel SB**

NOTES. – *Carbonea vorticosa* is a high elevation species and was collected at the summit of several California mountains including San Gorgonio and Mount Whitney by H.A. Imshaug in 1955 (CNALH 2015). It is infrequent in the San Bernardino Mountains above 2167 meters on granite.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Highway 38 and Rainbow Lane, 34°10′22″N 116°43′05″W, 2439 m, 3.xi.2013, on large granite outcrop, *J. Kocourková s.n. & K. Knudsen* (UCR).

***Carbonicola anthracophila* (Nyl.) Bendiksky & Timdal SB, SJ, SR**

FIG. 18A

NOTES. – This species is usually found on old burnt wood and is frequent in San Bernardino National Forest. It was often treated in recent literature under the name *Hypocenomyce anthracophila* (Nyl.) P. James & G. Schneider however we follow Bendiksby and Timdal (2013) and recognize it as a member of *Carbonicola*. *Carbonicola anthracophila, C. myrmecina,* and *Hypocenomyce scalaris* can be used as indicators of previous fires. It is often found growing on *Calocedrus decurrens.*

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above Highway 138, near Burnt Mill Canyon, 34°16′25″N 117°19′07″W, 1107 m, 15.xi.2014, on bark of *Pseudotsuga macrocarpa*, *K. Knudsen 17046 & J. Kocourková* (UCR).

***Carbonicola myrmecina* (Ach.) Bendiksky & Timdal SB, SJ**

NOTES. – *Carbonicola myrmecina* is usually found on old burnt wood and can be used as an indicator of past fires. The squamules with brown soredia can be reduced in small patches and easily overlooked. It was previously treated as *Hypocenomyce castancocinerea* (Räsänen) Timdal but we follow Bendiksby and Timdal (2013) and recognize it as a member of *Carbonicola*. It was first collected in southern California in the San Gabriel and San Bernardino Mountains by H.E. Hasse (CNALH 2015).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Hall Canyon, UC Reserve, lower 4 Sisters Trail, 33°48′26″N 116°46′30″W, 1646 m, 8.xi.2013, on dry hard conifer wood with *Strangospora moriformis, K. Knudsen 16314* (UCR).

***Catapyrenium daedaleum* (Kremp.) Stein SB**

NOTES. – *Catapyrenium daedaleum* was collected by B.D. Ryan in a montane soil crust in the Eastern Brook Lakes Watershed in the Sierra Nevada Mountains in the Inyo National Forest (CNALH 2015). Recently *C. daedaleum* was collected in a high elevation biotic soil crust above Dollar Lake in the San Bernardino Mountains. It is evidently rare in southern California, and known from this single collection, which is a southern range extension in the state. It is generally rare in western North America and is otherwise known from single collections from Oregon and Arizona (CNALH 2015).

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Dollar Lake, 34°07′22″N 116°51′11″W, 2678 m, 6.vi.2013, in montane biological soil crust, *J. Kocourková 8135 & K. Knudsen* (UCR, hb. K&K).

***Circinaria arida* Owe-Larsson, A.Nordin & Tibell SB, SJ**

NOTES. – This is a common species especially in the southern California deserts. On the desert floor it is often found growing on the more protected edges of rocks and small pebbles. It usually occurs on non-calcareous rock but occasionally occurs on calcareous rock at Cactus Flats in the San Bernardino Mountains. It was collected at 2753 meters on Tahquitz Peak in the San Jacinto Mountains. This taxon was previously treated under the name *Aspicilia desertorum* (Kremp.) Mereschk, which was found to have been misapplied by Owe-Larsson et al. (2011). For photographs of the species refer to Knudsen et al (2013a) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, pebble plain along Polique Canyon Rd., 34°18′18″N 116°51′03″W, on small pebbles, 2282 m, 25.viii.2011, *K. Knudsen et al. 13676.2* (UCR).

***Circinaria contorta* (Hoffm.) A.Nordin, S.Savić & Tibell SB, SJ**

NOTES. – This is a common calciphile in San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′14″N 116°47′27″W, 1850.2 m, 9.vi.2004, on dolomite, *K. Knudsen 3337 & M. Knudsen* (UCR).

***Cladonia acuminata* (Ach.) Norrlin SB**

NOTES. – *Cladonia acuminata* is presumed to be a Pleistocene relic in southern California, known from several populations on Santa Cruz Island and one in the Santa Ana Mountains in biological soil crusts. All populations in southern California lacked podetia and had low concentrations of the secondary metabolites atranorin and norstictic acid. The species is also known from a single population in the San Bernardino Mountains which lacked podetia like the other southern California populations and had low levels of secondary metabolites.

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 2N02, 34°15′21″N 116°44′05″W, 2027 m, 20.iii.2014, locally abundant on slope in soil crusts on soft sandy alluvium of pinyon-juniper woodland, *K. Knudsen et al. 16508* (NY, UCR).

***Cladonia cariosa* (Ach.) Spreng. SB**

NOTES. – *Cladonia cariosa,* like *C. acuminata,* is at the southern edge of its distribution in California and the populations collected on the summit of San Gorgonio in biotic soil crusts had no podetia. This is a rare species in California and this is the only known population in southern California.

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, summit of San Gorgonio, 34°06′00″N 116°50′11.27″W, 3409 m, 12.ix.2015, in biological soil crusts, *A.R. Pigniolo 854* (UCR).

***Cladonia fimbriata* (L.) Fr. SB, SJ**

NOTES. – *Cladonia fimbriata* is rare in San Bernardino National Forest but it usually produces its distinctive podetia. Sometimes sterile populations of reduced squamules on organic matter break down into

leprose patches. For photographs of the species refer to McCune and Rosentreter (2007) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Highway 38 and Rainbow Lane, 34°10′22″N 116°43′05″W, 2439 m, 3.xi.2013, with moss on wood of *Calocedrus decurrens, K. Knudsen 16812 & J. Kocourková* (UCR).

***Cladonia pulvinella* S.Hammer SB, SJ**

NOTES. – *Cladonia pulvinella* has granular soredia and is a common species in southern California. *Cladonia hammeri* Ahti, which has previously been reported from southern California, is now treated as a synonym (Pino-Bodas et al. 2013). All specimens identified as *C. nashii* Ahti or *C. hammeri* by the first author from southern California previous to 2015 are *C. pulvinella*. *Cladonia nashii* is now considered a rare species with fine soredia that is largely restricted to the Channel Islands in southern California with some scattered coastal mainland populations like in Laguna Beach (CANLH 2015, Pino-Bodas et al. 2013). *Cladonia pulvinella* forms extensive soil crusts on steep slopes of granitic alluvium in the Santa Ana Mountains as well as on the soft Bautista Formation on the west slope of San Jacinto Mountains. It is the most common *Cladonia* in San Bernardino National Forest and is usually cup-forming. Southern California populations always produce fumaprotocetraric acid, but the atranorin may be absent or at low concentrations only detected with TLC. Boureiganic acid has not been detected in any southern California populations. For a photograph of this species refer to Pino-Bodas et al. (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, N-facing slope above 1N09, 34°10′01″N 117°08′27″W, 884 m, 3.i.2014, on granitic soil, *K. Knudsen et al. 16405* (UCR).

***Cladonia pyxidata* (L.) Hoffm. SB, SJ**

NOTES. – We include in *Cladonia pyxidata* specimens that could also be identified as *C. chlorophaea*. This treatment is tentative until the circumscriptions of *C. chlorophaea* and *C. pyxidata* are revised (Ahti & Stenroos 2013). This is not a particularly important question in southern California as specimens are rare and poorly developed, usually without podetial squamules or even cups and are hard to identify to species. Only two collections are known from the San Bernardino Mountains and three from the western side of San Jacinto Mountains (CNALH 2015). For photographs refer to McCune and Rosentreter (2007) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Keller Cliffs, 34°09′45″N 117°08′27″W, 1195 m, 3.i.2014, on moss over granite-derived soil, *K. Knudsen et al. 16431.2* (UCR).

***Cladonia subulata* (L.) F.H. Wigg. SB, SJ**

NOTES. – This species is widespread in southern California on granitic soils in biotic soil crusts. But it is rare in San Bernardino National Forest. Expanded cups or proliferations from the edge of the cup were not seen in any southern California populations. For picture of *C. subulata* see Sharnoff (2014).

Selected specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.**:** San Bernardino Mountains, above Highway 138, west of Burnt Mill Canyon, 34°16′25.3″N 117° 19′07.9″W, 1107 m, on soil over granite boulder, 15.xi.2014, *K. Knudsen 17051 & J. Kocourková* (UCR).

***Clavascidium lacinulatum* (Ach.) M.Prieto var. *lacinulatum* SB, SJ**

NOTES. – *Clavascidium lacinulatum* is common in soil crusts throughout southern California, stabilizing them with its well-developed rhizohyphae. It is likewise common in biotic soil crusts in the southern California deserts where it often grows with *Enchylium coccophorum*. It is still well known by the name *Placidium lacinulatum* (Ach.) Breuss which was widely used previously in the literature. Of the multiple infrapsecific taxa recognized by Breuss (2002) this is the common variety in southern California soil crusts. For photographs of the species see McCune and Rosentreter (2007 as *P. lacinulatum*) and Knudsen et al. (2013a)

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near 1NO1, 34°14′57″N 116°42′52″W, 2144 m, 10.xii.2014, on granite-derived soil, *K. Knudsen 17256 & M. Crawford* (UCR).

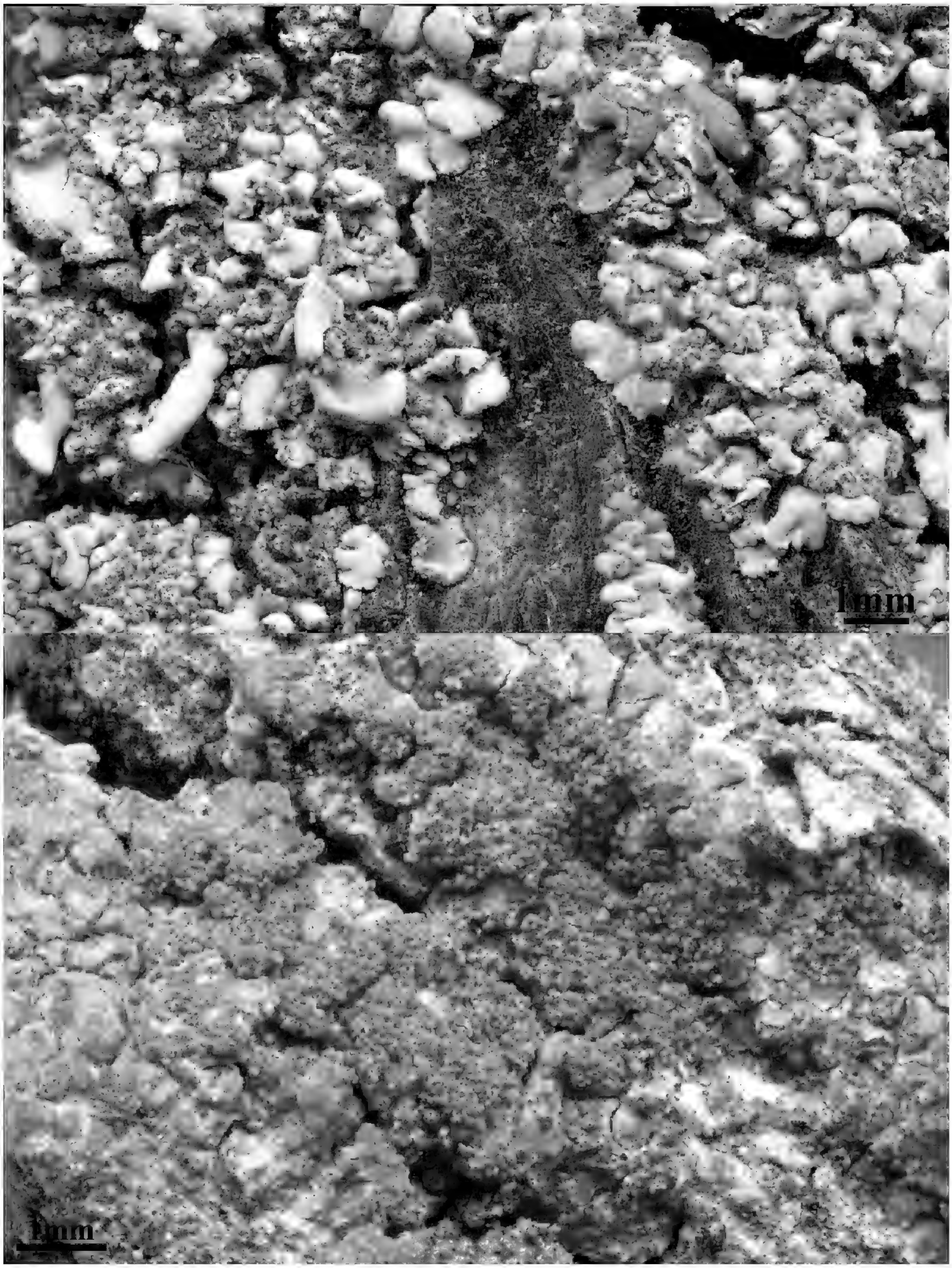

Figure 18. Photographs of selected species of San Bernardino National Forest lichens. Top: *Carbonicola anthracophila* (*Knudsen 17046*, UCR). Bottom: *Gyalolechia persimilis* (*Knudsen 15200*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Clavascidium lacinulatum* var. *erythrostratum* (Breuss) M.Prieto SJ**

NOTES. – The variety is distinguished from the typical one by the reddish underside of the squamules (Breuss 2002). Whether this and the other infraspecific taxa proposed by Breuss (2002) merit continued rcognition requires further study. This taxon occurs in the Sonoran Desert interface of the San Jacinto Mountains.

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, slope above Snow Creek, 33°52′29″N 116°40′54″W, 950 m, 15.xii.2003, on granitic soil, *K. Knudsen 733 & K. Kramer* (LI, UCR; det. O. Breuss).

***Collema furfuraceum* (Arnold) DuRietz SB, SJ**

NOTES. – Matthias Schultz identified two collections of *Collema furfuraceum* from the San Bernardino Mountains. Unfortunately these were without location data and collected by H.E. Hasse long ago (CNALH 2015). It has not been rediscovered in that range. Nonetheless the species is known from one collection made in the San Jacinto Mountains. Refer to Brodo et al. (2001) and Sharnoff (2014) for photographs of the species.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains. road from Banning to Idyllwild, 1980 m, 25.ii.1973, on bark of *Quercus*, *T.H. Nash 7076* (ASU; det. M. Schultz)

***Cyphelium inquinans* (Sm.) Trevisan SB, SJ**

NOTES. – *Cyphelium inquinans* is common in California. In the San Jacinto Mountains it is common on the dead wood of manzanita (*Arctostaphylos* species) and rotting conifer wood. It was collected in 19ll by H.E. Hasse at Pine Crest in the San Bernardino Mountains (voucher at FH) but there have been no modern collections from that range. For photographs of the species refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, near Highway 234 above Deer Springs Trail, 33°45′14″N 116°43′20″W, 1700 m, 4.v.2009, on wood of *Arctostaphylos, K. Knudsen 11022* (NY, UCR).

***Cyphelium karelicum* (Vainio) Räsänen SJ**

NOTES. – *Cyphelium karelicum* was collected growing alone, instead of with its common associate *C. inquinans*, and is currently known from a single location in San Bernardino National Forest. This is a southern range extension from Yosemite where it is common (Hutten et al. 2013). On same tree was growing southern most population of *Bryoria fremontii*.

Selected reference specimen. – **U.S.A. CALIFORNIA**. RIVERSIDE CO.: San Jacinto Mountains, Thomas Mt., 33°37'13.43"N 116°40'8.62"W, 2067 m, 14.xi.2016, on shady slope on wood of *Calocedrus decurrens* partly burnt long ago, *J. Kocourková 9233 & K. Knudsen* (Hb. K&K).

***Cyphelium pinicola* Tibell SJ, SR**

NOTES. – This yellow species is common on conifer wood in the San Jacinto Mountains and Lendemer collected it on Santa Rosa Mountain (voucher at NY). For a photograph of this species refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, ridge SE of Black Mountain, 33°48′48″N 116°43′30″W, 2086 m, 1.x.2003, on dead wood of *Pinus jeffreyi, K. Knudsen 506 & K. Kramer* (ASU, NY, UCR).

***Cyphelium tigillare* (Ach.) Ach. SB, SJ**

NOTES. – This yellow species is rare in San Bernardino National Forest. It was collected at Pine Crest in the San Bernardino Mountains by H.E. Hasse (voucher at ASU, det. by L. Tibell). For a photograph of this species refer to Wirth et al. (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Onyx Summit, 2570 m, 9.viii.1975, on *Juniperus* wood, *T.H. Nash 11234* (ASU; det. L. Tibell).

***Cyphelium trachylioides* (Nyl. *ex* Branth & Rostr.) Erichsen SJ**

NOTES. – This species is rare in North America but is frequent in the area of the San Jacinto Mountains from Herkey Ridge and Apple Canyon to Garner Valley where it was first collected by T.H. Nash in 1973 on a wood fence and it was later collected in 1977 by L. Tibell (CNALH 2015).

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Apple Canyon, 33°41′19″N 116°39′14′W, 1506 m, 31.i.2006, on wood of *Pinus jeffreyi*, *K. Knudsen 5115 & J.C. Lendemer* (UCR).

***Dermatocarpon americanum* Vainio SB, SJ**

NOTES. – This is the most common species of *Dermatocarpon* in southern California. Though it usually occurs on non-calcareous rock, it has also been collected on dolomite at Cactus Flats in the San Bernardino Mountains and hard limestone in the Clark Mountains (UCR 2015). *Dermatocarpon americanum* has a positive reaction to Melzer′s solution and the medulla turns red, but the reagent should be applied carefully with capillary tubes, sometimes several times, to get the best test results. For photographs of the species refer to Knudsen et al. (2013a) and Sharnoff (2014).

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Devil′s Slide, 33°46′13″N 116°43′03″W, 2114 m, 15.ix.2006, on soft decaying granite, *K. Knudsen 7168* (UCR).

***Dermatocarpon miniatum* (L.) W.Mann SB**

NOTES. – This is a common species in northern North America but is rare in southern California, only known in San Bernardino Mountains above 1800 meters elevation. It has been reported further north in California from Yosemite National Park (Hutten et al. 2013). This is a southern range extension in the state. *Dermatocarpon taminium* occurs on San Gorgonio Peak and has longer ascospores, but looks externally similar and also has a negative reaction of medulla to Melzer′s solution as does *D. miniatum*. For a photograph of this species refer to McCune and Geiser (2009).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Dollar Lake, 34°07′22″N 116°51′11″W, 2678 m, 5.vii.2012, on schistose rock, *K. Knudsen 14701 & J. Kocourková* K. (UCR).

***Dermatocarpon moulinsii* (Mont.) Zahlbr. SJ**

NOTES. – This is a rare species in southern California and is only known in San Bernardino National Forest from Black Mountain in the San Jacinto Mountains.

Specimens examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Black Mountain, 33°44′23″N 116°45′30″W, 2337 m, 22.ix.2003, on granite boulder, *K. Knudsen et al. 489.1* (ASU, SBBG, UCR).

***Dermatocarpon reticulatum* H.Magn. SJ**

NOTES. – This is a rare species in southern California. It was collected a few times in the San Gabriel Mountains by B.D. Ryan (CNALH 2015) and once in the San Jacinto Mountains by J.C. Lendemer**.** It is the common species of *Dermatocarpon* elsewhere in western North America, including further north in California in Yosemite National Park (Hutten et al 2013). For a photograph of this species refer to McCune and Geiser (2009).

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′49″N, 116°44′24″W, 1650 m, 6.x.2008. on granite, *J.C. Lendemer 14813 & K. Knudsen* (NY).

***Dermatocarpon taminium* Heidmarsson SB**

NOTES. – *Dermatocarpon taminium* is the most common *Dermatocarpon* in the mountains of the Sonoran Desert in Arizona (CNALH 2015). Bruce Ryan collected it in the Sierra Nevada Mountains at 2600 meters elevation in Fresno County (UCR) and it was collected in Yosemite National Park (Hutten et al. 2013). In southern California it occurs on San Gorgonio Peak. The species looks similar to *D. miniatum*, which also has a negative reaction of the medulla to Melzer′s solution, and occurs in the San Bernardino Mountains, but *D. taminium* has longer ascospores.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge to San Gorgonio Mountain along Vivian Creek Trail, 34°05′11″N 116°50′20″W, 3051 m, 19.vii.2015, on granite, *A.R. Pigniolo 782.2* (UCR)

***Dimelaena lichenicola* K.Knudsen, Sheard, Kocourk. & H.Mayrh. SB**

NOTES. – This species begins as a juvenile fungal parasite on *Dimelaena oreina* and *D. thysanota*, eventually developing an independent lichenized brown thallus. It was recently described from Joshua Tree National Park and the lower elevations of the Italian Alps. A small amount of material was collected in the San Bernardino Mountains and it is expected to occur in San Jacinto Mountains. For a photograph and description refer to Knudsen et al. (2013b).

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Highway 38 and Rainbow Lane, 34°10′22″N 116°43′05″ W, 2439 m, 3.xi.2013, on *Dimelaena oreina*, *K. Knudsen 16292.2 & J. Kocourková* (UCR).

***Dimelaena oreina* (Ach.) Norman SB, SJ**

NOTES. – This species is common in San Bernardino National Forest on hard granite at middle to high elevations. For photographs of the species refer to Knudsen et al. (2013b) and Sharnoff (2014). The specimen cited below represents the stictic acid chemotype of the species

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, below Onyx Summit, 34°12′08″N 116°45′08″ W, 2439 m, on granite boulder, 16.ix.2004, *K. Knudsen 1712* (NY, UCR).

***Dimelaena radiata* (Tuck.) Müll.Arg. SJ**

NOTES. – This species is probably the most common lichen along the coast of southern and central California. Scattered populations occur inland through the Santa Ana Mountains and Menifee Hills to the Santa Rosa Hills along Bautista Canyon on the border of San Bernardino National Forest (UCR 2015). The specimen cited below was from a solitary population found on a single granite rock. For similar inland distributions of a coastal species see the entires in this paper for *Polycauliona luteominia* var. *bolanderi* and *Psora pacifica*. For photographs of *Dimelaena radiata* refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, W side of Santa Jacinto Mountains, Santa Rosa Hills above Bautista Canyon, 33°40′02″N 116°50′17″W, 954 m, 9.ii.2004, on granite rock, *K. Knudsen 866* (UCR).

***Dimelaena thysanota* (Tuck.) Hale & W.L.Culb. SB, SJ**

NOTES. – This species is common in southern California and in San Bernardino National Forest, often growing with *Dimelaena oreina*. For photographs of the species refer to Knudsen et al. (2013a) and Sharnoff (2014).

Selected specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, NE of Heart Bar Peak, above Cienaga Seca Creek, 34°10′08″N 116°45′08″W, 2400 m, 16.ix.2004, on granite boulder, *K. Knudsen 1724* (UCR).

***Diploschistes muscorum* (Scop.) R.Sant. SJ**

NOTES. – This common species begins as a juvenile parasite on *Cladonia* species and eventually destroys the host, forming an independent lichenized thallus. Due to the general lack of *Cladonia* in San Bernardino National Forest, *Diploschistes muscorum* is rare in the San Jacinto Mountains and has not yet been collected in the San Bernardino Mountains. It usually grows on soil but also can grow directly onto rock, after destroying *Cladonia* growing on thin soil over rock. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, slopes above Dry Creek, 33°42′15″N 116°44′41″W, 1232 m, 23.i.2004, on soil over granite, *K. Knudsen et al. 784* (UCR).

***Diploschistes scruposus* (Schreb.) Norman SB, SJ**

NOTES. – This species is infrequent in San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, gorge on N slope along Highway 38, 34°09′31″N 116°56′26″W, 2124 m, 7.x.2008, on granite, *K. Knudsen 10425 & J.C. Lendemer* (UCR).

***Diplotomma alboatrum* (Hoffm.) Flot. SJ**

NOTES. – This species occurs from the deserts to the islands in southern California, but is never common. It is rare in the San Jacinto Mountains. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′49″N, 116°44′24″W,1650 m, on granite, 6.x.2008, *J.C. Lendemer 14862 & K. Knudsen* (NY).

***Enchylium coccophorum* (Tuck.) Otálora, P.M.Jørg. & Wedin SB, SJ**

NOTES. – This species is common in soil crusts in southern California especially growing with *Clavascidium lacinulatum* in the deserts and *Endocarpon pusillum* on the Channel Islands. Most previous reports and published accounts use the name *Collema coccophorum* Tuck., however we follow Otálora et al. (2014) and recognize the species as a member of *Enchylium.* For photographs of the species see Nash et al. (2004), McCune and Rosentreter (2007), Knudsen et al. (2013a), and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, end of Morris Ranch Rd., rocky slope of East Canyon, 33°39'23"N 116°35'07"W, 1720 m, 28.ix.2009, on sandfilled clefts in marble boulders, *M. Schultz 16620b & K. Knudsen* (HBG).

***Enchylium tenax* (Sw.) Gray SJ**

NOTES. – This is a common species reported here from thin soil crusts over marble in the San Jacinto Mountains

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, end of Morris Ranch Rd., rocky slope of East Canyon, 33°39'23.8"N 116°35'07.2"W, 1720 m, on sandfilled clefts in marble boulders, 28.ix.2009, *M. Schultz 16620a & K. Knudsen* (HBG).

***Endocarpon loscosii* Müll.Arg. SB, SJ**

NOTES. – This species occurs in biological soil crusts throughout southern California. It is rare in San Bernardino National Forest. For a photograph of this species refer to McCune and Rosentreter (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°42′49″N 116°49′08″W, 1037 m, 5.ii.2004, on soil, *K. Knudsen et al. 840* (UCR).

***Endocarpon pallidulum* (Nyl.) Nyl. SB**

NOTES. – This saxicolous *Endocarpon* is frequent throughout coastal southern California. Nonetheless it is rare in the San Bernardino Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, on shaded wall of narrow canyon bottom, 34°13′35″N 116°40′22″ W, 1873 m, 10.xii.2014, on granite, *K. Knudsen 17292 & M. Crawford* (UCR).

***Endocarpon pusillum* Hedw. SJ**

NOTES. – This terricolous lichen has long rhizohyphae and is common in soil crusts in coastal southern California. In the study area it occurs in soil crusts on the west slope of the San Jacinto Mountains. For photographs of the species refer to McCune and Rosentreter (2007) and Sharnoff (2014). When growing on calcareous soil the species often produces a pruina (Knudsen & Kocourková 2012).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, bench above South Fork of San Jacinto River, 33°43′47″N 116°48′40″W, 648 m, 16.ii.2004, on soil, *K. Knudsen 840* (UCR).

***Evernia prunastri* (L.) Ach. SJ**

NOTES. – This is a common macrolichen of western North America and Europe and is locally abundant in scattered populations in southern California. H.E. Hasse collected it in the Santa Monica Mountains, the San Gabriel Mountains, and on the north edge of San Jacinto Mountains in Eden Hot Springs where it is probably extirpated (CNALH 2015). It is rare in the San Jacinto Mountains where it

occurs on upper Rouse Ridge with the only population of *Usnea hirta* in the San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°42′49″N 116°49′19″W, 865 m, 5.ii.2004, on *Adenostoma fasciculatum, K. Knudsen et al. 853* (UCR).

***Fulgidea sierrae* (Timdal) Bendiksby & Timdal SJ**

NOTES. – This species occurs at high elevations in the San Jacinto Mountains, on usually burnt conifer wood, but so far has not been collected in the San Bernardino Mountains. It has been collected in the San Gabriel Mountains, on Palomar, and in the Cuyamaca Mountains (CNALH 2015). Most previous reports used the name *Hypocenomyce sierrae* Timdal but we follow Bendiksby and Timdal (2013) and recognize it as a member of *Fulgidea*. It is another species that usually indicates previous fires.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Fuller Ridge, 33°50′15″N 116°44′11″W, 2347 m, 2.x.2008, on conifer wood, *J.C. Lendemer 14559 & K. Knudsen* (NY).

***Gloeoheppia rugosa* Henssen SJ**

NOTES. – This species was hitherto only known from Lanzarote in the Canary Islands, where it occurs in seepage tracks on volcanic rock accompanied by other Lichinaceae and cyanobacteria. The present material collected on marble near the end of Morris Ranch Road in the San Jacinto Mountains anatomically matches the features characteristic of *Gloeoheppia* and keys to *G. rugosa* in the thorough treatment of the genus by Henssen (1995). The thallus is composed of aggregations of irregularly shaped, erect areoles or small squamules with a fairly conspicuous coarsely granulose or rugose surface texture. However, our identification remains tentative since the samples collected are sterile. It is here reported new for North America and California.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, end of Morris Ranch Rd., rocky slope of East Canyon, 33°39'23"N 116°35'07"W, 1720 m, 28.ix.2009, on inclined marble boulders, *M. Schultz 16621a* & *K. Knudsen* (HBG).

***Gyalecta herrei* Vězda SJ**

NOTES. – This corticolous species usually occurs near the coast in southern and central California. It is rare in San Beranrdino National Forest, where it was collected on a fir tree above a perennial granite pool in the San Jacinto Mountains. For a photograph of this species refer to Knudsen and Kocourková (2012).

Specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto Mountains, 33°48′00″N 116°44′05″W, 1731 m, 28.vii.2008, scattered on mature bark of *Abies concolor*, *K. Knudsen 9998 & J. Kocourková* (UCR).

***Gyalolechia persimilis* (Wetmore) Søchting, Frödén & Arup SJ**

FIG. 18B

NOTES. – This sorediate corticolous species is frequent in southern California especially on oaks. In California its soredia are usually yellow but it is usually a reddish color in Texas (Wetmore 2004). It is rare in the San Jacinto Mountains. This species is commonly known by the name *Caloplaca persimilis* Wetmore, however we follow Arup et al. (2013) and treat it in *Gyalolechia* here.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Pinyon Flats, 33°35′05″N 116°27′27″ W, 1217 m, 8.xi.2013, on dry wood of living *Juniperus*, *K. Knudsen 16305* (UCR).

***Gyalolechia subbracteata* (Nyl.) Søchting, Frödén & Arup SJ**

NOTES. – This species is commonly known by the name *Fulgensia subbracteata* (Nyl.) Poelt, however we follow Arup et al. (2013) and treat it in *Gyalolechia* here. It is a rare species in southern California. In the study area it occurs on Seven Level Hill along Highway 74 in the San Jacinto Mountains in the Sonoran Desert interface, where it was also observed by the first author as well as collected by C. Bratt (SBBG). The nearest known population is located in Berdoo Canyon in Joshua Tree National Park in the Little San Bernardino Mountains (Knudsen et al. 2013a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Seven Level Hill, along Highway 74, 441 m, 10.xi.1988, *C. Bratt 7075 & E. Timdal* (SBBG).

***Heppia adglutinata* (Kremp.) A.Massal. SJ**

NOTES. – *Heppia adglutinata* is infrequent in soil crusts in southern California where it occurs from the islands to the deserts at lower elevations. It is usually sterile in southern California.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Santa Rosa Hills above Bautista Canyon, 33°40′02″N 116°50′17″W, 954 m, 9.ii.2004, on granite-derived soil, *K. Knudsen 860* (UCR).

***Heteroplacidium compactum* (A.Massal.) Gueidan & Cl.Roux SJ**

NOTES. – This species is common in the Mojave Desert and was collected in the Sonoran Desert interface of the San Jacinto Mountains. It is expected to occur on granite on the Mojave interface of the San Bernardino Mountains. For a photograph of this species refer to Knudsen et al. (2013a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Pinyon Flats near base of Sugarloaf Mountain, 33°35′05″ N 116°26′24″W. 1238 m, 10.viii.2012, *K. Knudsen 15034* (UCR).

***Heteroplacidium zamenhofianum* (Clauz. & Cl.Roux) Gueidan & Cl.Roux SB**

NOTES. – This calciphile is common on calcareous rock in the Cactus Flats area of the San Bernardino Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′14″N 116°47′28″W, 1846 m, 9.vi.2005, *K. Knudsen 3383* (UCR; det. O. Breuss).

***Hypocenomyce scalaris* (Ach. *ex* Lilj.) M.Choisy SB, SJ, SR**

NOTES. – This is a common species in conifer forests in southern California especially on old burnt wood. It is good indicator of previous fires in the region. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Angelus Oaks area, 34°09′25″N 116°55′51″W, 1833 m, 2.xi.2013, on *Calocedrus decurrens*, *K. Knudsen 16300 & J. Kocourková* (UCR).

***Hypogymnia imshaugii* Krog SJ**

NOTES. – H.E. Hasse collected this macrolichen in Strawberry Valley in Idyllwild, east of the North Fork of the San Jacinto River, but no modern collections have been made in this area. Under the name *Parmelia physodes entermorpha* Tuck., he reported it as being common "throughout the range on shrubs and trees" though he actually did not collect farther east than South Ridge (Hasse 1906). It is probably extirpated except from the areas between 5000 and 7000 feet west of the North Fork of San Jacinto River to Black Mountain where *H. imshaugii* still festoons the upper story of the conifers. In this area there has not been recorded a major fire according to Forest Service records (S. Eliason, *pers. comm.*).

Hypogymnia imshaugii used to be common in the San Bernardino Mountains on the coastal side of the range, with many collections especially from the Rim of the World by early southern California botanist F.M. Reed (see e.g., UCR, US[n.v.]). The last modern collection was made in 1943 by S. Shushan (COLO[n.v.]) from the Lake Arrowhead area. Conventional lichenological wisdom holds that the cause of its extirpation was air pollution. The first author and T.H. Nash III visited the Rim of the World in 2004 and Nash was convinced *H. imshaugii* had disappeared because of nitrates and ozone. However we assert that its disappearance is caused by fire, as this popular recreation area has had frequent fires since the 1920′s according to Forest Service records (S. Eliason, *pers. comm.*). Based on our observations trees throughout the Rim of the World area generally lack lichens, and we attribute this phenomenon to the combination of frequent fires and a continuing trend of declining rainfall with periodic droughts.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Hall Canyon, UC James Reserve, 33°48′37″N 116°46′27″W, 1671 m, 13.viii.2012. in upper story of conifers on branches, *K. Knudsen 15082* (UCR).

Kaernefeltia merrillii **(DuRietz) Thell & Goward SJ**

NOTES. – This species is common on chaparral at lower elevations in the coastal ranges of southern California. It grows on the western side of the San Jacinto Mountains. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, lower Thomas Mountain, 33°35′25″N 116°37′23″W, 1456 m, 24.x.2003, *K. Knudsen 553 & K. Kramer* (UCR).

Lathagrium fuscovirens **(With.) Otálora, P.M.Jørg. & Wedin SB**

NOTES. – This cyanolichen is more commonly known as *Collema fuscovirens* (With.) J.R. Laundon however we follow Otálora et al. (2014) and treat it in *Lathagrium.* It was collected in the Mojave Desert interface of the San Bernardino Mountains, where it was rare. For a photograph of this species refer to Nash et al. (2004).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rattlesnake Canyon, 34°13′51″N 116°39′36″W, 1803 m, 10.xii.2014, on granite and moss over granite, *K. Knudsen 17224 & M. Crawford* (UCR).

Lathagrium undulatum **(Flot.) Otálora, P.M. Jørg. & Wedin var.** ***granulosum*** **Degel. SB**

NOTES. – This taxon resembles *Lathagrium fuscovirens*, but differs from the latter in the distinctly undulating lobes with smooth surfaces and in the absence of pustules or blisters. Fertile specimens can easily be separated by the presence of four-celled, narrow-ellipsoid ascospores (vs. submuriform, fusiform ascospores in *L. fuscovirens*). For a photograph and description of this taxon refer to Brodo et al. (2001). Note that we follow Otálora et al. (2014) and treat this taxon in *Lathagrium*

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flat SE of junction of Rd. 18 and Smarts Ranch Rd. (FR 3N03), rocky slope, 34°18'16"N 116°47'55"W, 1860 m, 27.ix.2009, on NW-exposed marble boulders, *M. Schultz 16619a* (HBG).

Lecania brunonis **(Tuck.) Hasse SJ**

NOTES. – Most *Lecania* species in southern California occur along the coast and in the coastal ranges. They are common on the Channel Islands. There are two collections of the coastal *L. brunonis* species from the west side of San Jacinto Mountains. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: W of San Jacinto Mountains in hills above Bautista Canyon, 33°40′13″N 116°50′07″W, 744 m, 29.xii.2011, on soft granite in shade with mosses, *K. Knudsen 14505* (UCR).

Lecania polycycla **(Anzi) Lettau SB**

NOTES. – This species is a calciphile and is common on dolomite in the Cactus Flats area of the San Bernardino Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′14″N 116°47′27″W, 1850 m, 12.vi.2005, on dolomite, *K. Knudsen 3335B* (UCR).

Lecanora albellula **Nyl. SB, SJ**

NOTES. – This is the most common *Lecanora* on conifer wood at high elevations in San Bernardino National Forest. This species has an N+ epihymenium and produces isousnic acid together with usnic acid (Printzen 2001). For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge along Arctic Circle, 34°14′48″N 117°00′08″W, 2159 m, 9.vi.2014, on dry wood of conifer stump, *K. Knudsen 16876* (UCR).

Lecanora allophana **(Ach.) Nyl. SB, SJ**

NOTES. – *Lecanora allophana* and *L. chlarotera* are the two most frequent epiphytic members of the *L. subfusca* group in San Bernardino National Forest. *Lecanora allophana* is distinguished primarily by

its egranulose epihymenium and the occurrence of only atranorin with or without chloratranorin as a minor substance. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Staircase Canyon, 34°10′40″N 116°56′ 26″W, 1522 m, 25.vii.2015, on *Alnus rhombifolia, K. Knudsen 17577.3 & J. Kocourková* (UCR).

***Lecanora anopta* Nyl. SJ**

NOTES. – This species was reported new to California from the Sierra Nevada Mountains in Yosemite National Park (Hutten et al. 2013). It is here reported new for southern California, a southern range extension. For a description and photograph refer to Pérez-Ortega et al. (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Black Mountain, 33°49′28″N 116°45′31″W, 2349 m, 8.viii.2012, on dry wood of dead conifer stump, *K. Knudsen 15013* (SBBG, UCR).

***Lecanora austrocalifornica* Lendemer & K.Knudsen SB, SJ**

FIG. 19A

NOTES. – This common southern California species occurs on the wood of conifers, oaks and *Arctostaphylos* in San Bernardino National Forest. It was described from Apple Canyon in the San Jacinto Mountains where it was found on fallen *Pinus jeffreyi* twigs. It is common in the Sierra Nevada Mountains (Hutten et al. 2013). For a description refer to Lendemer and Knudsen (2009).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Garner Valley, 33°35′28″N 116°36′19″W, 1423 m, 8.xi.2013, on dry dead twigs of living *Quercus cornus-mulleri, K. Knudsen 16304* (UCR).

***Lecanora cadubriae* (A.Massal.) Hedl.,** Bih. Kgl. Sv. Vet. Akad. Handl. 18, 3 (3): 48 (1892).
SB, SJ

FIG. 19B

= *Lecidea xanthococcoides* Zahlbr., Bull. Torr. Bot. Club 27: 644. 1900. TYPE: **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Seven Oaks, 1700 m, 1900, on conifers (on *Abies concolor*), *H.E. Hasse 705* (W[n.v.], holotype; PH!, topotype).

NOTES. – This species occurs on conifer wood and on the bark of *Abies concolor*. While it is not dominant, it is frequent in high elevation corticolous communities in San Bernardino National Forest. For some time we had been curious as to the application of the name *Lecidea xanthococcoides* which was described from the San Bernardino Mountains, and here it is recognized as a synonym of *Lecanora cadubriae*.

Selected additional specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, San Jacinto State Park, 33°48′39″N 116°39′02″W, 2699 m, 3.vi.2013, on bark of *Abies concolor* and on rotting logs, *K. Knudsen 15860* (UCR).

***Lecaora cenisia* Ach. SB, SJ**

NOTES. – This is a common montane *Lecanora* species that occurs on granite in San Bernardino National Forest. It has been found on both San Gorgonio and San Jacinto Peaks. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, San Jacinto Peak, 33°48′53″N 116°40′46″W, 3306 m, 25.x.2015, on granite, *A.R. Pigniolo 941* (SBBG).

***Lecanora chlarotera* Nyl. SB, SJ**

NOTES. – This species is frequent in San Bernardino National Forest where it is found in corticolous communities on the bark of conifers, *Alnus rhombifolia* Nutt., and *Quercus kelloggii*. In our species concept it may or may not contain gangaleoidin. In sunny sites the apothecia can become dark and it is sometimes mistaken for *L. circumborealis* Brodo & Vitik. For a photograph of this species refer to Sharnoff (2014).

Figure 19. Photographs of selected species of San Bernardino National Forest lichens. Top: *Lecanora austrocalifornica* (*Knudsen 16875*, UCR). Bottom: *Lecanora cadubriae* (*Knudsen 16297*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge along Arctic Circle, 34°14′38″N 116°58′48″W, 2010 m, 20.xii.2004, on bark of *Pinus jefferyi.*, *K. Knudsen 2077 & C. Wagner* (UCR; gangaleoidin not detected by TLC).

Lecanora formosa **(Bagl. & Carestia) Knoph & Leuckert SB**

NOTES. – This species is common in the Rocky Mountains in Colorado and has a scattered distribution in Asia, Europe, and North America. It was separated from *Lecidella bullata* Körber (Knoph & Leuckert 2000; Hertel & Schuhwerk 2010). It is not known at this time if *L. bullata* occurs in North America, but our specimen matches the current concept of *L. formosa* (e.g., Knoph & Leuckert 2000; Edwards et al. 2009). For its current phylogenetic position see Zhao et al. (2016). For a description of this species refer to Edwards et al (2009). According to Hertel and Schuhwerk (2010), the photograph of *L. bullata* is *L. formosa* in Thomson (1997).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio, 34°05′00″N 116°50′11″ W, 3409 m, 13.ix.2015, on granite, *A.R. Pigniolo 904.2* (UCR).

Lecanora gangaleoides **Nyl. SB, SJ**

NOTES. – This species is common on granite in San Bernardino National Forest, especially in the northwest end of San Jacinto Mountains. It also occurs along the coast and on the Channel Islands. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Black Mountain, 33°49′2″N 116°45′31″ W, 2349 m, 8.viii.2012, on granite, *K. Knudsen 15030* (UCR).

Lecanora hybocarpa **(Tuck.) Brodo SJ**

NOTES. – This species is apparently rare in San Jacinto Mountains. For a photograph of this species refer to Bordo et al. (2001).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Devil's Slide, 33°45′55″N 116°41′07″W, 1997 m, 15.ix.2006, on bark of *Pinus jeffreyi, K. Knudsen 7215* (UCR).

Lecanora laxa **(Śliwa & Wetmore) Printzen SB, SJ**

FIG. 20A

NOTES. – This species is common on the bark and wood of conifers in San Bernardino National Forest. It has an N- epihymenium, small almost globose ascospores, and usnic acid with or without isousnic acid (Printzen 2001).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, South Ridge below Tahquitz Peak, 33°45′11″N 116°40′53″W, 2408 m, 19.viii.2006, on bark of *Abies concolor*, *K. Knudsen 7081* (UCR).

Lecanora mellea **W.A.Weber SB, SJ**

FIG. 20B

NOTES. – This species has a beautiful brown thallus and is common farther north in the Sierra Nevada Mountains. It is infrequent in San Bernardino National Forest.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Pinnacles, 34°17′43″N 117°12′49″ W, 1426 m, 13.xii.2013, on granite, *Knudsen et al. 16342.1* (UCR).

Lecanora munzii **K.Knudsen & Lendemer SB**

NOTES. – This species is frequent in the San Bernardino Mountains. It has an N+ violet epihymenium but the C spot test often does not detect the small amounts of gyrophoric acid. For a description and photograph refer to Knudsen and Lendemer (2009), and for further discussion refer to Knudsen (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Pinnacles: above Pinnacles Trail 3W16 in granite, 34°17′45″N 117°12′53″W, 1388 m, 13.xii.2013on old manzanita wood with *Lecanora austrocalifornica*, *K. Knudsen et al. 16359.1* (UCR).

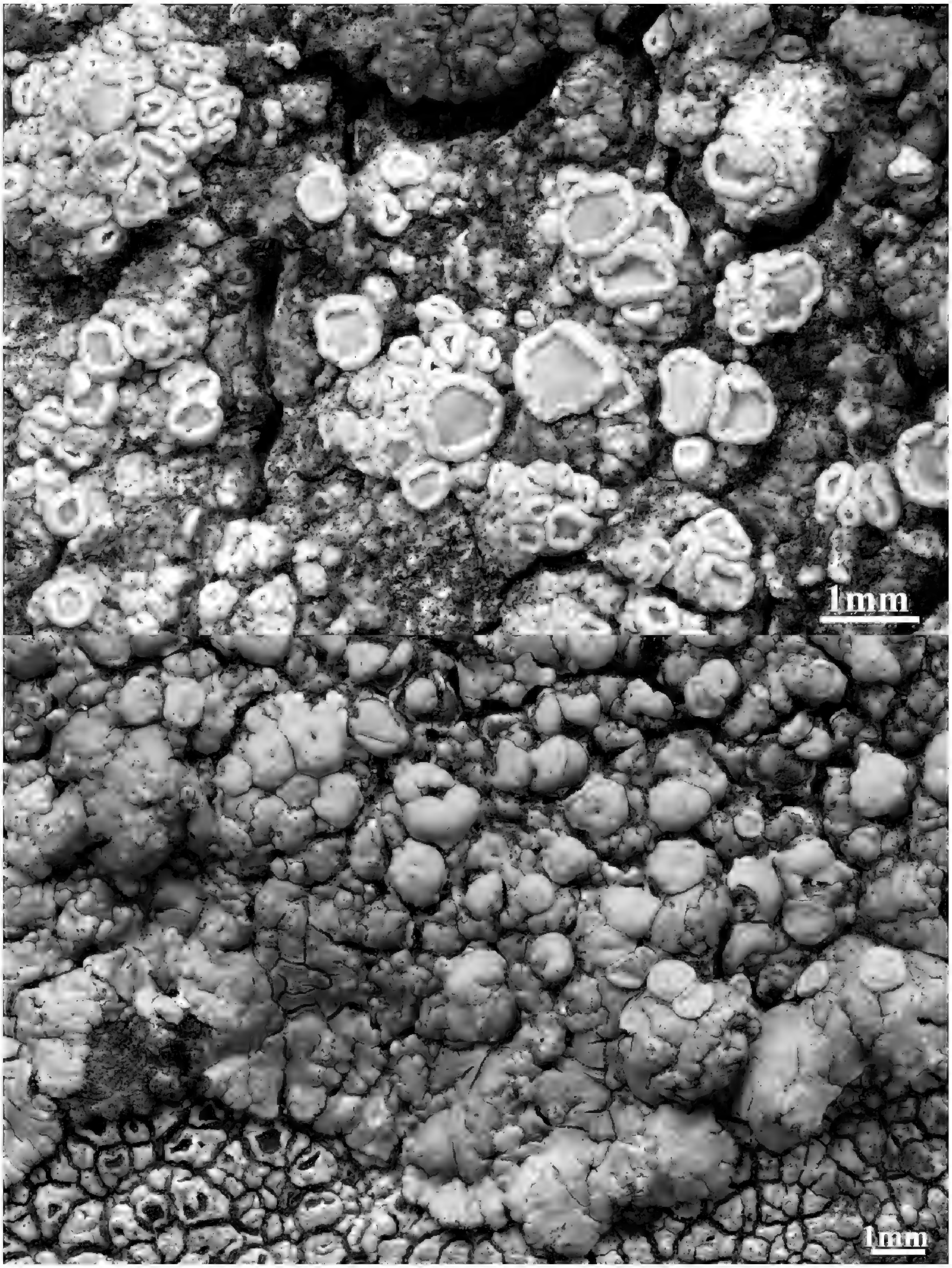

Figure 20. Photographs of selected species of San Bernardino National Forest lichens. Top: *Lecanora laxa* (*Knudsen 7081*, UCR). Bottom: *Lecanora mellea* (*Knudsen 1056*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Lecanora peninsularis **K.Knudsen, Lendemer & Elix SJ**

FIG. 21A

NOTES. – This species is only known from its type locality in the San Jacinto Mountains where it was found on rotting conifer wood. For a description refer to Knudsen et al. (2011b).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Idyllwild, 33°43′37″N 116°45′03″W, 1598 m, 4.v.2009, on conifer wood, *K. Knudsen 11021* (NY, PRM, UCR).

Lecanora polytropa **(Ehrh.) Rabenh. SB, SJ**

NOTES. – This is a common species on granite above about 1800 meters elevation. It occurs on the summit of San Gorgonio. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, summit of San Gorgonio, 34°05′57″N 116°49′29″W, 3491 m, 6.vi.2012, on granite, *M. Harding s.n.* (UCR, det. by K. Knudsen)

Lecanora pseudistera **Nyl. SJ**

NOTES. – This species has a scattered distribution in the Coastal Ranges and foothills of southern California. It sometimes occurs in biotic soil crusts. In the study area it is known from two collections that were made at high elevations in the San Jacinto Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, south of trail to Tahquitz, 33°46′05″N 116°39′37″W, 2425 m, 10.vii.2006, on boulder in shade by stream, *K. Knudsen 6841* (UCR).

Lecanora rupicola **(L.) Zahlbr. SB, SJ**

NOTES. – *Lecanora rupicola* is frequent on granite in San Bernardino National Forest and was collected once on dolomite in the San Bernardino Mountains. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Holcomb Valley, 34°18′11″N 116°52′45″ W, 2120 m, 18.xi.2014, on granite boulder, *K. Knudsen 17109 & J. Kocourková* (UCR).

Lecanora saligna **(Schrad.) Zahlbr. SB, SJ**

NOTES. – *Lecanora saligna* is the most common *Lecanora* species on wood in San Bernardino National Forest. On *Pinus ponderosa* Douglas *ex* C.Lawson in the San Bernardino Mountains, it is usually the only lichen collected. For a photograph of this species refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Delmar Mountain, 34°18′04″N 116°56′05″W, 2194 m, 12.vii.2015, on snag of *Pinus ponderosa* in full sun, *K. Knudsen 17556* (NY, UCR).

Lecanora semitensis **(Tuck.) Zahlbr. SB, SJ, SR**

NOTES. – *Lecanora semitensis* is rare in San Bernardino National Forest. For a description and photographs of this species see Lendemer et al. (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Thomas Mountain, 33°38′39″N 116°42′24″W, 1643 m, 5.x.2008, on granite, *J.C. Lendemer 14807 & K. Knudsen* (NY).

Lecanora sierrae **B.D.Ryan & T.H.Nash SB, SJ, SR**

FIG. 21B

NOTES. – *Lecanora sierrae* is common in San Bernardino National Forest. Specimens subjected to TLC by one of the authors (JCL) all represented the fatty acid chemotype. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, first ridge crest, Vivian Creek Trail above High Creek, 34°05′05″N 116°50′27″W, 3035 m, 19.vii.2015, on granite, *A.R. Pigniolo 773* (UCR).

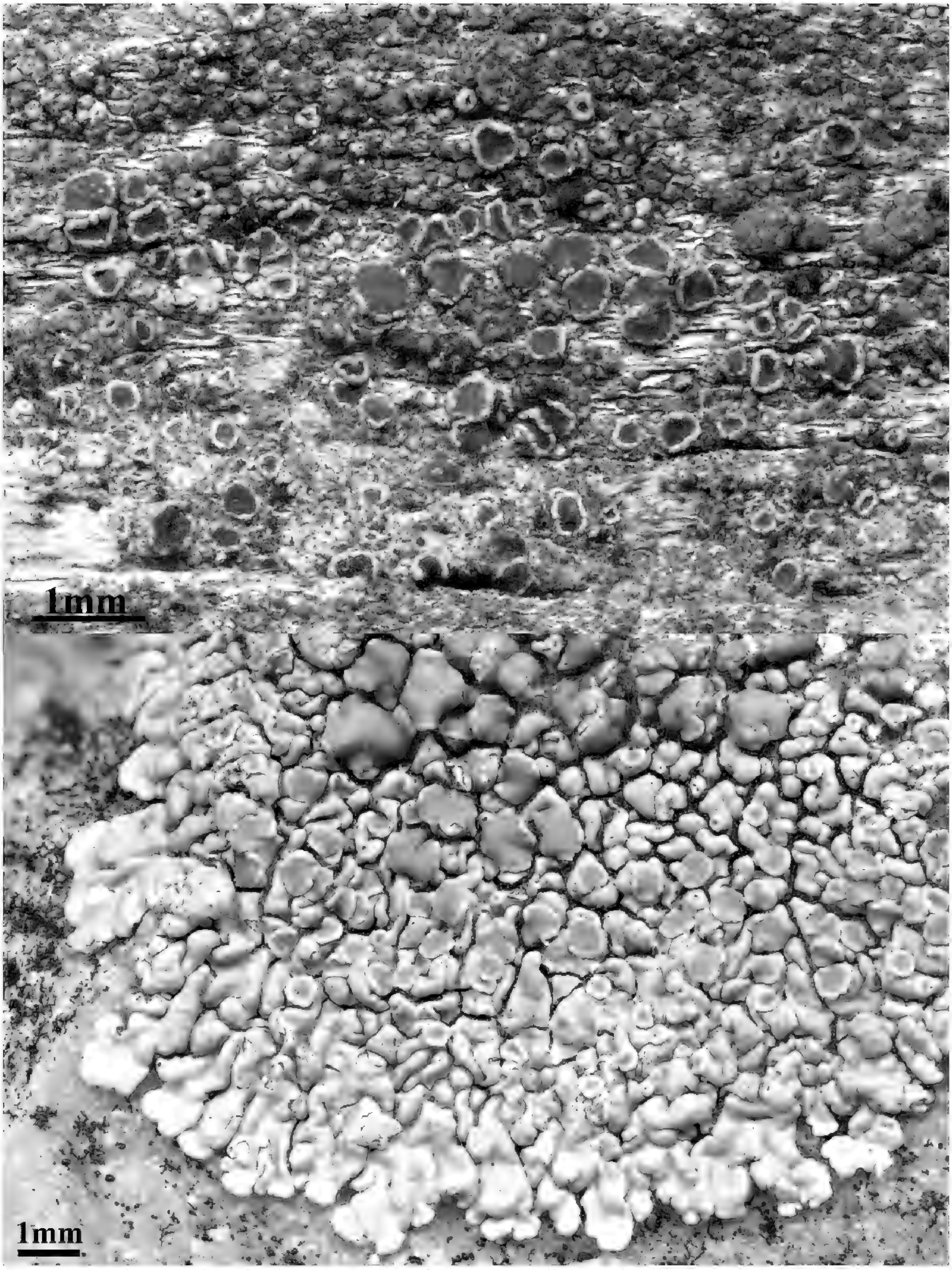

Figure 21. Photographs of selected species of San Bernardino National Forest lichens. Top: *Lecanora peninsularis* (*Knudsen 11021*, UCR). Bottom: *Lecanora sierrae* (*Knudsen 10410*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Lecanora stenotropa **Nyl. SB, SJ**

NOTES. – *Lecanora stenotropa* looks similar to *L. polytropa* and is common in the San Bernardino National Forest where the two species are sympatric. The two species differ in ascospore size, with *L. stenotropa* having longer ascospores than those of *L. polytropa* (Ryan et al. 2004).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Big Bear Valley, 34°14′32″N 116°58′40″W, 2134 m, 3.v.2007, on granite, *K. Knudsen et al. 8337* (UCR).

Lecanora subimmergens **Vainio SJ**

NOTES. – *Lecanora subimmergens* is frequent on sandstone in the Coastal Ranges of southern California and on the Channel Islands. It is rare on the west slope of the San Jacinto Mountains where it occurs on decaying granite.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Fuller Ridge, 33°.41′ 52″N 116°45′09″W, 1229 m, 19.iv.2004, on granite. *K. Knudsen* 957 (UCR).

Lecanora utahensis **H.Magn. SB**

FIG. 22A

NOTES. – *Lecanora utahensis* is rare in the San Bernardino Mountains. It looks like *Acarospora strigata* in the field. This species occurs in southern California on calcareous rock and all specimens tested from San Bernardino Mountains and San Nicolas Island in California lacked isousnic acid which is produced by the type from Utah. Charis Bratt collected *L. utahensis* in Jacoby Canyon in the San Bernardino Mountains (SBBG!). For another photograph of this species refer to Śliwa (2007).

Additional specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: South Peak (White Mountain), 34°20′31″N 117°5′59″W, 2313 m, 18.viii.2005, on limestone, *K. Knudsen 3448.2 & C. Wagner* (UCR).

Lecidea atrobrunnea **(Ramond *ex* Lam. & DC.) Schaer. SB, SJ**

NOTES. – *Lecidea atrobrunnea* s. str. contains confluentic with or without 2-*O*-methylperalotic acid in southern California and is common in San Bernardino National Forest from middle elevations up to approximately 2600 meters. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Fuller Ridge, 33°50′15″N 116°44′11″W, 2347 m, 2.x.2008, on granite. *J.C. Lendemer 14628 & K. Knudsen* (NY).

Lecidea cascadensis **H.Magn SJ**

FIG. 22B

NOTES. – *Lecidea cascadensis* is infrequent in the San Jacinto Mountains on granite. and occurs also in the Santa Monica Mountains and on Palomar Mountain. *Lecidea fuscoatrina* Hertel & Leuckert is a synonym (Hutten et al. 2013). The species occurs in Sequoia and Yosemite National Parks in the Sierra Nevada Mountains north to Washington (Hutten et al. 2013).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50″N 116°44′41″W, 1756 m, 9.v.2005, on granite, *J.C. Lendemer 4148 & K. Knudsen* (NY, UCR).

Lecidea cinerata **Zahlbr. SJ**

FIG. 23A

NOTES. – *Lecidea cinerata* appears to be a rare southern California endemic. It was described from the Santa Monica Mountains on decaying granite above Hollywood (Hasse 1913). In the study area it occurs on west side of the San Jacinto Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′52″N 116°49′29″W, 1682 m, 20.v.2005, on granite, *K. Knudsen et al. 1159.1* (UCR).

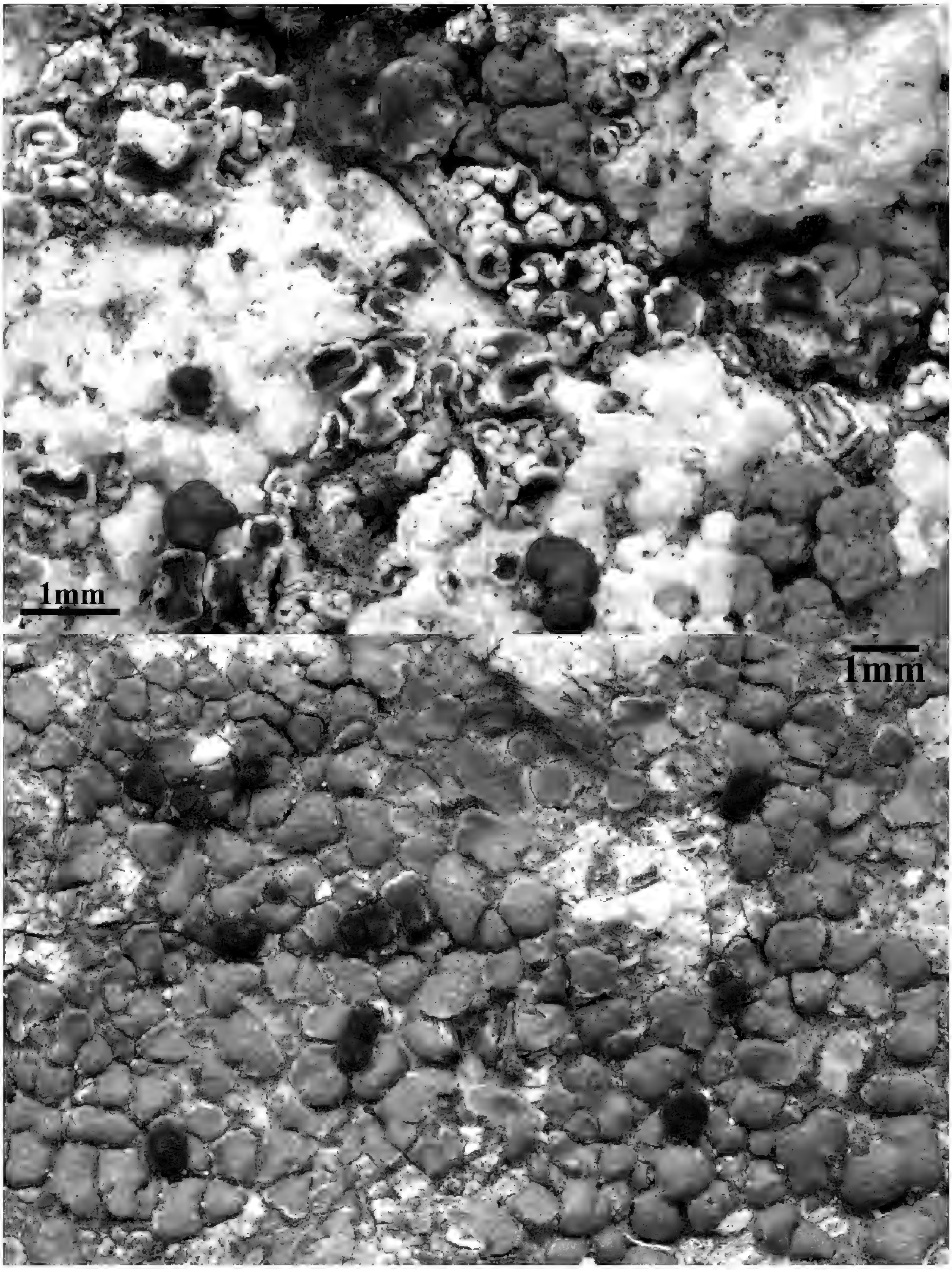

Figure 22. Photographs of selected species of San Bernardino National Forest lichens. Top: *Lecanora utahensis* (*Knudsen 3448*, UCR). Bottom: *Lecidea cascadensis* (*Knudsen 7886*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Lecidea diducens **Nyl. SB, SJ**

NOTES. – *Lecidea diducens* occurs in San Bernardino National Forest at the highest elevations. Several specimens were collected by H.A. Imshaug in 1955 on the summit of San Gorgonio where it is frequent (CNALH 2015). This name was often misapplied by North American lichenologists in the past in California to many other species of *Lecidea.*

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio Peak, 34°05′57″N 116°49′28″W, 3491 m, on granite, 19.vii.2012, *A.R. Pigniolo 802* (UCR).

Lecidea erythrophaea **Flörke *ex* Sommerf. SB**

NOTES. – *Lecidea erythrophaea* was first collected in southern California by H.E. Hasse in the Santa Monica Mountains, where it apparently was common, but has not been collected since 1916 (Hertel & Printzen 2004). There is a historical collection from Santa Cruz Island that was made by C.F. Baker in 1904, and was determined by C. Printzen (CNALH 2015). The only collection made in southern California since those of Hasse and Baker was in the San Bernardino Mountains. It was not collected in Yosemite National Park (Hutten et al. 2013). Evidently it is common in interior western North America (McCune et al. 2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Highway 38 and Rainbow Lane, 34°10′22″N 116°43′05″ W, 2439 m, 2.xi.2013, on dry conifer wood, *K. Knudsen 16282.1 & J. Kocourková* (UCR)

Lecidea fuscoatra **(L.) Ach. SB, SJ**

NOTES. – *Lecidea fuscoatra* is a common species in California and in the San Bernardino NF. It is occasionally found growing in biotic soil crusts in the Santa Ana Mountains and on Santa Cruz Island. For a photograph of this species refer to Sharnoff (2014).

Selected specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Idyllwild, 33°43′36″N 116°45′3″W, 1602 m, on granite, 4.xiii.2005, *K. Knudsen 3453* (UCR, TLC in solvent C, J.C. Lendemer, 2006: gyrophoric acid syndrome).

Lecidea hassei **Zahlbr. SB, SJ**

NOTES. – *Lecidea hassei* is common in southern California. Many populations are clustered in the Little San Bernardino Mountains in the Mojave Desert in Joshua Tree National Park (Knudsen et al. 2013a). It is known from granite in the Cactus Flats area in the Mojave interface of the San Bernardino Mountains. In the San Jacinto Mountains it occurs at high elevations in conifer forests. For a photograph of this species refer to Knudsen et al. (2013a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Tahquitz Peak, 33°45′21″N 116°40′40″W, 2638 m, 4.x.2004, on granite rubble, *K. Knudsen 1780.3* (UCR)

Lecidea holopolia **(Tuck.) Zahlbr. SJ, SR**

NOTES. – *Lecidea holopolia* is frequent in the San Jacinto Mountains where it occurs on rotting conifer wood. One of us (JCL) collected it once in the Santa Rosa Mountains (NY). It also occurs on Palomar Mountain.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Hall Canyon, U.C. James Reserve, lower Four Sisters Trail, 33°48′26″N 116°46′30″W, 1646 m, 8.xi.2013, on rotting log of burnt *Calocedrus decurrens*, *K. Knudsen 16316* (UCR).

Lecidea kingmanii **(Hasse) Hertel & S.Ekman SB, SJ**

FIG. 23B

NOTES. – This species is currently considered endemic to the mountains of southern California. The bryologist C.C. Kingman collected the holotype in the San Gabriel Mountains (Hasse 1913). It produces 4-0-demethylplanaic acid (confirmed by TLC of the holotype, FH!). In the study area it occurs at high elevations on granite and schistose rock in both the San Jacinto and San Bernardino Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Dollar Lake, 34°07′22″N 116°51′11″W, 2678 m, 5.vi.2012, on schistose rock, *K. Knudsen 14704 & J. Kocourková* (UCR).

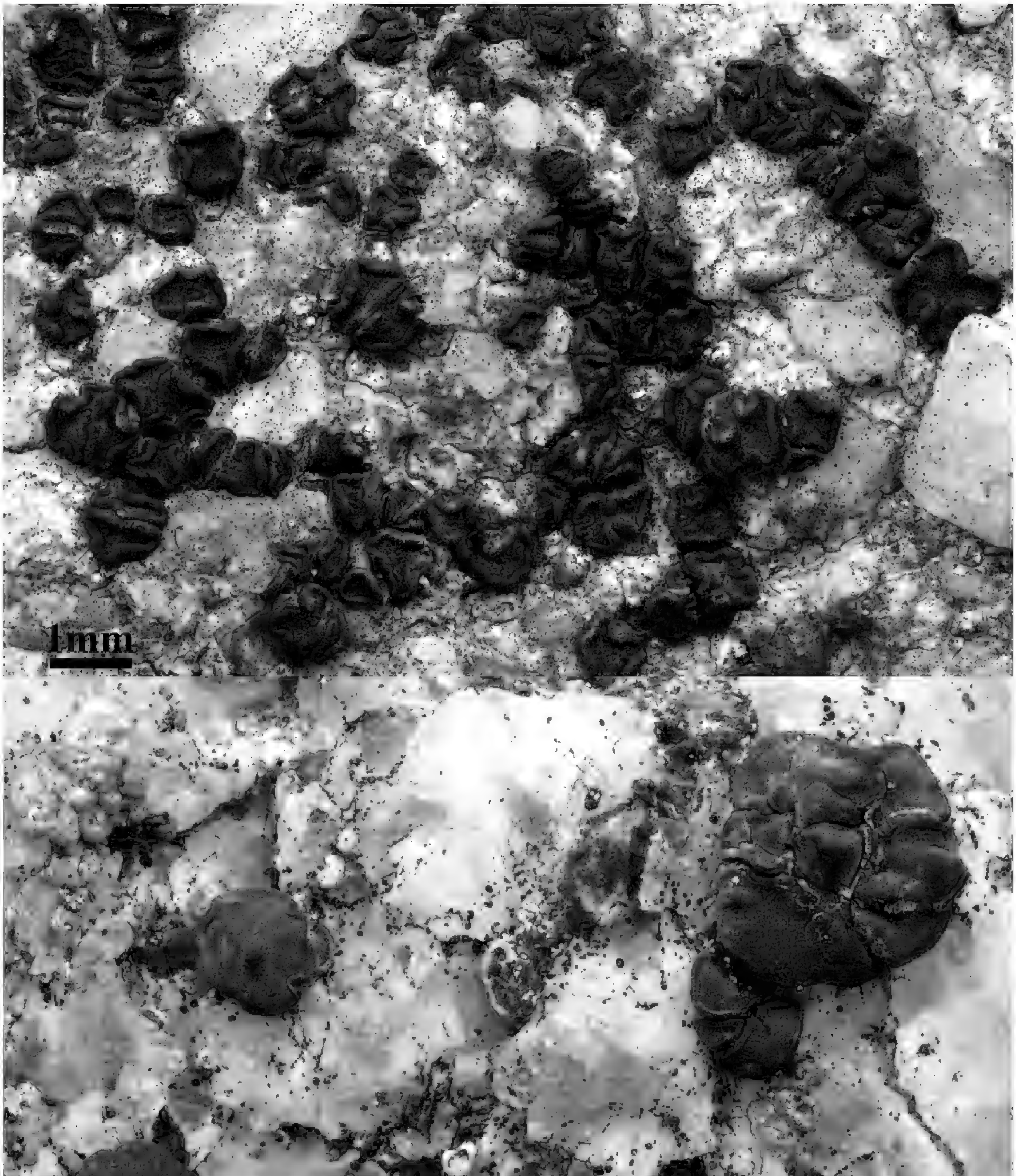

Figure 23. Photographs of selected species of San Bernardino National Forest lichens. Top: *Lecidea cinerata* (*Knudsen 9257*, UCR). Bottom: *Lecidea kingmanii* (*Pigniolo 780*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Lecidea laboriosa* Müll.Arg. SB, SJ**

NOTES. – *Lecidea laboriosa* is the most common endolithic *Lecidea* species in southern California and is distributed from the Channel Islands to the Mojave Desert. The species usually produces 4-0-demethylplanaic acid, but occasionally specimens lack concentrations that can be detected with TLC. Specimens near the coast and on the islands occasionally have a thin dirty white ecorticate thallus.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, The Saddle, 33°46′26″N 116°40′23″W, 2467 m, 23.vii.2004, on granite boulders, *K. Knudsen 1502* (UCR).

***Lecidea mannii* Tuck. SB, SJ**

NOTES. – *Lecidea mannii* has a scattered distribution in southern California from the Coastal Ranges to the Mojave Desert and is nowhere locally abundant.

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, above Pacific Crest Trail, 33°34′18″N 116°34′10″W, 1491 m, 8.v.2005, on granite, *J.C. Lendemer 4224 & K. Knudsen* (NY, PH, UCR).

***Lecidea oreophila* K.Knudsen & Kocourk. SB, SJ**

NOTES. – *Lecidea oreophila* was described from Black Mountain in the San Jacinto Mountains**.** It appears to be frequent in the San Bernardino Mountains at high elevations. Interestingly it was collected on San Clemente Island at the same site by C. Bratt (SBBG!) and K. Knudsen, where it is probably a pioneer species, its ascospore blown in by the winds from the mountains on the horizon. For a photograph and description refer to Knudsen and Kocourková (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Black Mountain, 33°49′28″N 116°45′31″W, 2349 m, 8.viii.2012, on granite, *K. Knudsen 15013* (UCR).

***Lecidea perlatolica* Hertel & Leuckert SB**

FIG. 24A

NOTES. – *Lecidea perlatolica* is rare in the San Bernardino Mountains. It is a high elevation species in Sierra Nevada Mountains (Hutten et al. 2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains**,** 2N15, 34°14′15″N 117°00′00″W**,** 2011 m, 24.ix.2015, on granite, *K. Knudsen 17925* (NY, UCR)

***Lecidea protobacina* Nyl. *ex* Hasse SB, SJ**

FIG. 24B

NOTES. – *Lecidea protobacina* was collected on the summit of Mt. Baldy in the San Gabriel Mountains, on Tahquitz Peak in San Jacinto Mountains, and on San Bernardino Peak in San Bernardino Mountains by H.E. Hasse (1913). This is the oldest available name for the high elevation members of *L. atrobrunnea* group that is typified by a western North American specimen. This group has its center of diversity in western North America. *Lecidea atrobrunnea* subsp. *stictica* Hertel & Leuckert is a synonym of *L. protobacina* and we here use the latter name to recognize the taxon at the species level. *Lecidea protobacina* is infrequent in San Bernardino National Forest.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Devil's Slide, 33°46′27″N 116°40′23″W, 2472 m, 15.ix.2006, on granite, *K. Knudsen 7185* (UCR)

***Lecidea syncarpa* Zahlbr. SB, SJ**

NOTES. – *Lecidea syncarpa* is a member of the high elevation *Lecidea atrobrunnea* group that can be recognized by the production of norstictic acid. *Lecidea atrobrunnea* subsp. *saxosa* Hertel & Leuckert is a synonym of *L. syncarpa* and we here use the latter name to recognize the taxon at the species level. This species is common in San Bernardino National Forest and H.A. Imshaug collected it on summit the of San Gorgonio (CNALH 2015). For a photograph of this species refer to cover of McCune et al. (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Tahquitz Peak, 33°45′20″N 116°40′43″W, 2609 m, 4.x.2004, on granite, *K. Knudsen 1790.1* (UCR).

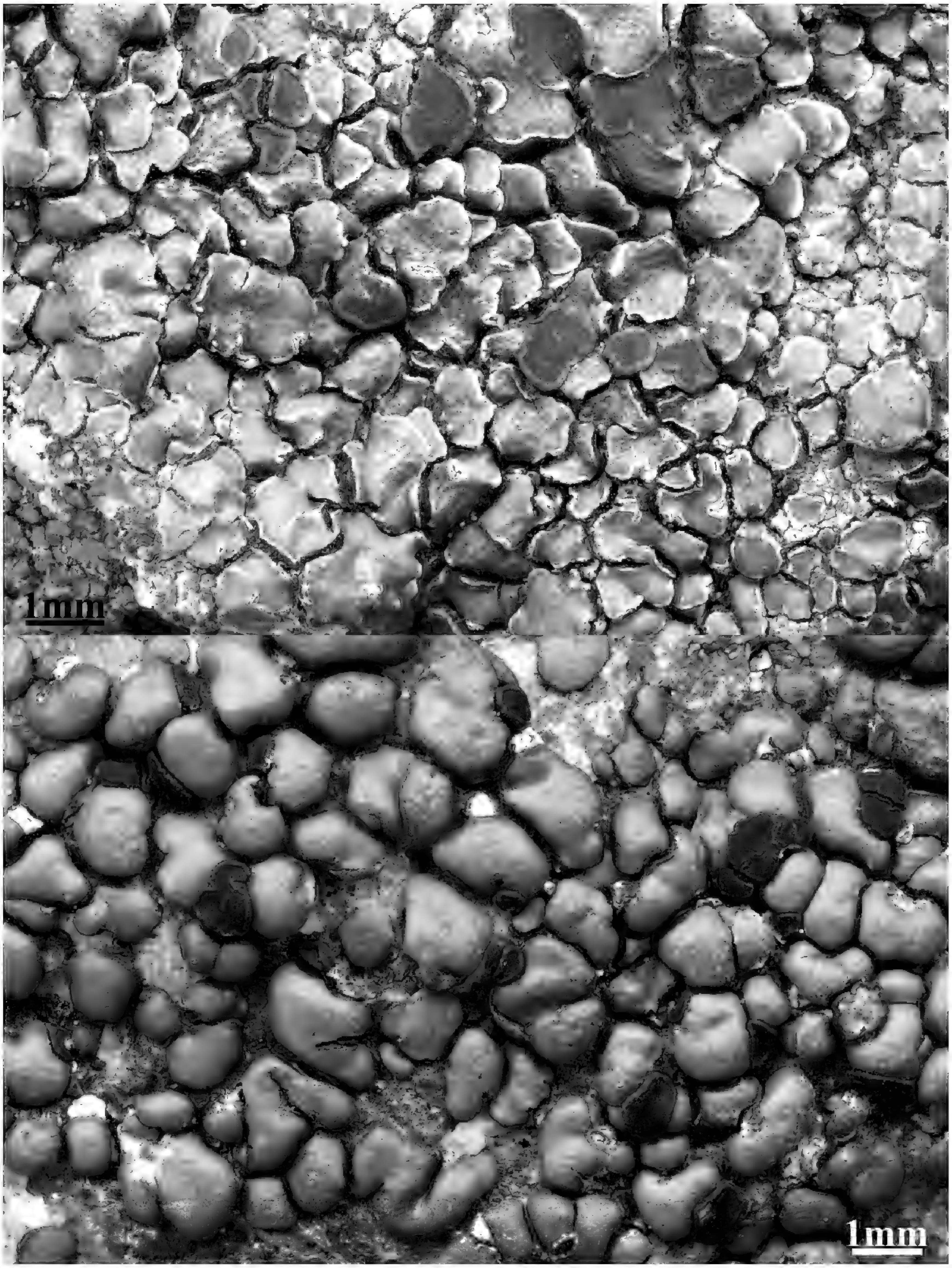

Figure 24. Photographs of selected species of San Bernardino National Forest lichens. Top: *Lecidea perlatolica* (*Knudsen 17925*, UCR). Bottom: *Lecidea protobacina* (*Knudsen 14697*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Lecidea tessellata* Flörke SB, SJ**

NOTES. – *Lecidea tessellata* is common in San Bernardino National Forest. It can only be confused with *L. oreophila*. For differences between those two species refer to Knudsen and Kocourková (2014). For photographs of *L. tessellata* refer to Sharnoff (2014).

Selected specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Devil's Slide, 33°46′02″N 116°41′08″W, 2056 m, frequent on granite boulders, 15.ix.2006, *K. Knudsen 7156* (UCR; TLC in Solvent C: confluentic acid, J.C. Lendemer, 2006).

***Lecidea truckeei* Herre SB, SJ, SR**

FIG. 25A

NOTES. – *Lecidea truckeei* was collected by T.H. Nash on Onyx Summit in the San Bernardino Mountains (CNALH 2015). Following Lendemer and Knudsen (2007) we treat *Lecidea schizopeltica* Hertel & Leuckert as a synonym of *L. truckeei*.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Rosa Mountain, on north slope, 33°32′13″N 116°18′11″W, 2214 m, 8.x.2008, on granite *J.C. Lendemer 14985 & K. Knudsen* (NY).

***Lecidella asema* (Nyl.) Knoph & Hertel SJ**

NOTES. – *Lecidella asema* is common in southern California near the coast and on the Channel Islands. A few populations occur in the San Jacinto Mountains in shaded humid microhabitats, especially on Thomas Mountain. For a photograph of this species refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Thomas Mountain, 33°38′39″N 116°42′24″W, 1643 m, 5.x.2008, on granite, *J.C. Lendemer 14803 & K. Knudsen* (NY, UCR).

***Lecidella carpathica* Körber SB, SJ**

NOTES. – *Lecidella carpathica* is common in southern California and in San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Black Mountain, 33°49′28″N 116°45′31″W, 2349 m, 8.viii.2012, on granite, *K. Knudsen 15015* (UCR).

***Lecidella euphorea* (Flörke) Hertel SB, SJ**

NOTES. – *Lecidella euphorea* is infrequent in San Bernardino National Forest where it occurs on shrubs and was collected on *Pinus jeffreyi* once. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Keller Cliffs area, slope above 1N09, 34°09′45″N 117°08′27″ W, 1195 m, 3.i.2014, on smooth bark of *Quercus berberidifolia* Liebm., *K. Knudsen et al. 16427* (UCR).

***Lecidella stigmatea* (Ach.) Hertel & Leuckert SB, SJ**

NOTES. – *Lecidella stigmatea* is common in southern California and in San Bernardino National Forest. In southern California, it often has a poorly developed thallus in study area. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Jacoby Canyon, 34°19′6″N 116°49′40″W, 1939 m, 18.viii.2005, on soft granite, *K. Knudsen 3536 & C. Wagner* (UCR).

***Lepraria eburnea* J.R.Laundon SJ**

NOTES. – *Lepraria eburnea* is rare in the San Jacinto Mountains, known only from Halfway Springs (on some labels this locality is referred to as Baywood or Boxwood Springs). For a description and photograph of the species refer to Lendemer (2013a).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Halfway Springs, 33°44′31″N, 116°47′11″W, 1034 m, 11.x.2008, on wood, *J.C. Lendemer 11487 & K. Knudsen* (NY, UCR).

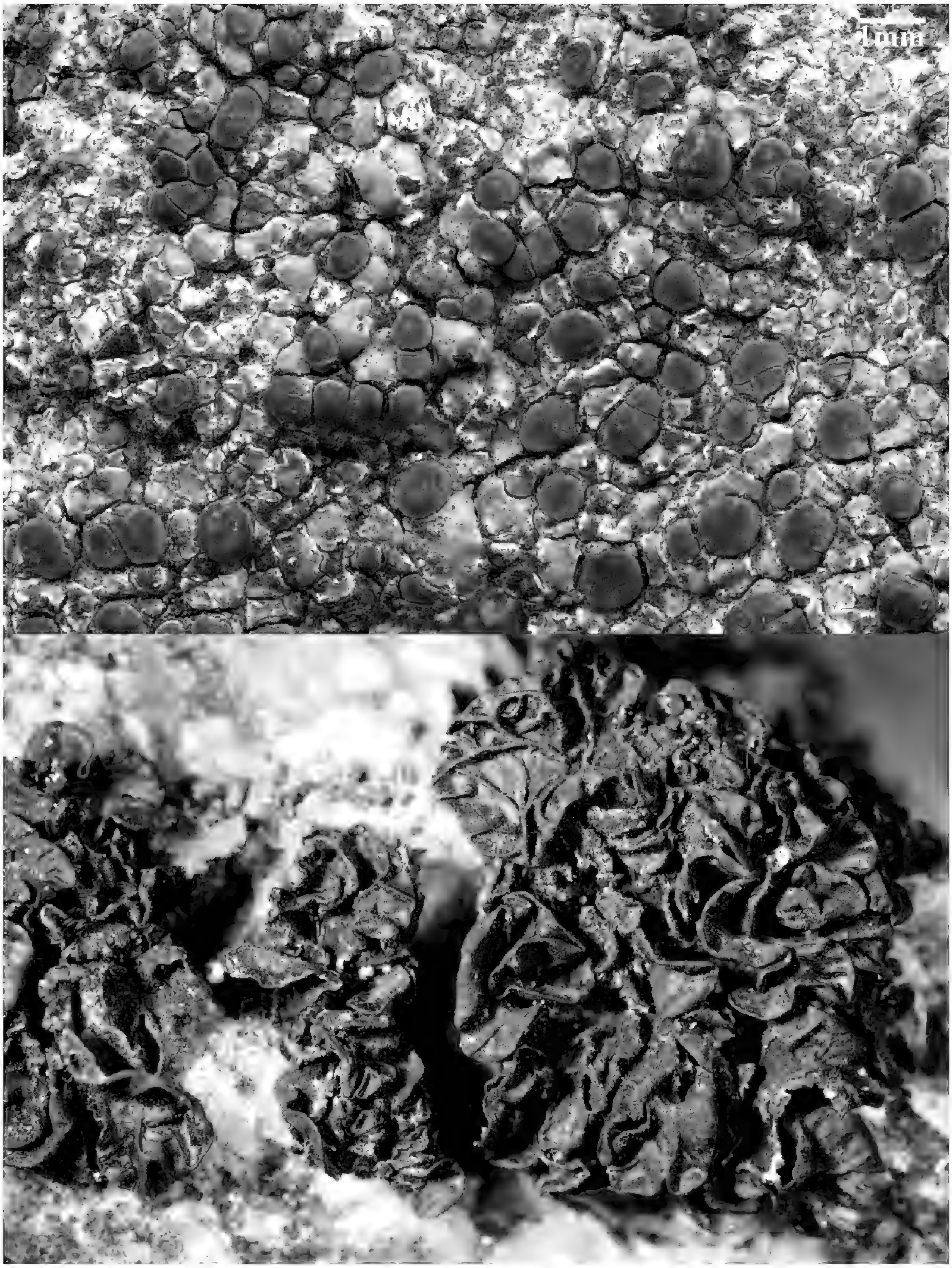

Figure 25. Photographs of selected species of San Bernardino National Forest lichens. Top: *Lecidea truckeei* (*Knudsen 9109*, UCR; photograph by Tom Wheeler, copyright U.S. National Forest Service). Bottom: *Lichinella cribellifera* (*Schultz 16618A*, HBG; photograph by Matthias Schultz, copyright M. Schultz).

***Lepraria elobata* Tønsberg SJ**

NOTES. – *Lepraria elobata* is rare in the San Jacinto Mountains. For a description and photograph refer to Lendemer (2013a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Fuller Ridge, 33°50′15″N 116°44′11″W, 2348 m, 2.x.2008, on granite in overhang, *J.C. Lendemer 14612 & K. Knudsen* (NY)

***Lepraria neglecta* (Nyl.) Lettau SB, SJ, SR**

NOTES. – *Lepraria neglecta* is the most common sterile leprose crustose lichen in San Bernardino National Forest. Previously this species was divided into chemotypes but this was artificial and not supported by molecular data (Lendemer 2013b). For description, photographs and the discussion of chemotypes and synonyms refer to Lendemer (2013a). Variability of secondary metabolites that occur in *L. neglecta* in San Bernardino National Forest include the fatty acid chemotype, the fumaprotocetraric acid chemotype, the psoromic acid chemotype, and the stictic acid chemotype (see Lendemer 2013a, b). The voucher cited below represents the psoromic acid chemotype.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, FS 1N05 to Fish Creek, 34°08′54″N, 116°46′34″W, 2160 m, 7.x.2008, on moss on large granite boulder, *J.C. Lendemer 14934 & K. Knudsen* (NY).

***Lepraria rigidula* (B.de Lesd.) Tønsberg SJ**

NOTES. – *Lepraria rigidula* is rare in California, currently known from one location in the San Jacinto Mountains and one location in Yosemite National Park (Lendemer 2013a).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50″N 116°44′41″W, 1576 m, 9.v.2004, on granite and moss in underhang, *J.C. Lendemer 4135 & K. Knudsen* (NY, UCR).

***Leprocaulon adhaerens* (K.Knudsen, Elix & Lendemer) Lendemer & B.P.Hodkin. SB**

NOTES. – *Leprocaulon adhaerens* is common in southern California in the Coastal Ranges, but barely extends inland to the Wonderland of Rocks in Joshua Tree National Park (Knudsen et al. 2013a). It has not been collected in the San Jacinto Mountains, but several populations occur in the San Bernardino Mountains. For photographs of the species refer to Knudsen et al. (2007) under the name *Lepraria adhaerens* K. Knudsen, Elix & Lendemer. For photographs and discussion of apothecia, which are rare, refer to McCune and Rosentreter (2015).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Waterman Canyon, 34°12′26″N 117°17′09″W, 881 m, 23.xii.2013, on granite, *K. Knudsen et al. 16376* (UCR).

***Leprocaulon knudsenii* Lendemer & B.P.Hodkin. SJ**

NOTES. – *Leprocaulon knudsenii* is rare in the San Jacinto Mountains where it is known from a single location. Its type locality is in Fremont Canyon in the Santa Ana Mountains. For a description and photographs refer to Lendemer and Hodkinson (2013).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, N-facing slope above North Fork of San Jacinto Mountains, 33°47′49″N, 116°44′24″W, 739 m, 6.x.2008, on moist decomposing granite, *J.C. Lendemer 11417 & K. Knudsen* (NY, UCR).

***Leptochidium albociliatum* (Desm.) M.Choisy SJ**

NOTES. – *Leptochidium albociliatum* is the one of the most common cyanolichens in southern California. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Apple Canyon, 33°41′57″N 116°39′09″W, 1484 m, 24.ii.2010, on moss on seasonal seep, *K. Knudsen et al. 11859.1* (UCR).

***Letharia columbiana* (Nutt.) J.W.Thomson SB, SJ**

NOTES. – The bright yellow species *Letharia columbiana* is infrequent in the middle elevations of the San Jacinto Mountains but has not been collected since 1930 in San Bernardino Mountains (UCR) where populations were probably extirpated by frequent fires. It appears to be rare in San Jacinto

Mountains. It has abundant apothecia and never produces soredia. For more discussion see Altermann et al. (2016). For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Apple Canyon, 33°41′10″N 116°39′53″W, 1372 m, common on dead shrubs, 4.viii.2002, *R. Reifner Jr. 02-136* (UCR).

***Letharia lulpina* Altermann, Leavitt & Goward SB, SJ, SR**

NOTES. – *Letharia lupina* is common throughout San Bernardino National Forest. The species is distinguished in our region by its occurrence in montane habitats at middle to higher elevations and by abundant isidia and soredia. It lacks apothecia in almost all specimens examined from San Bernardino National Forest. *Letharia vulpina* (L.) Hue is rare and reduced in form in southern California at elevations below 700 meters. It cannot be distinguished morphologically from *L. lupina*. For more information see Altermann et al. (2016).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO. San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50″N 116°44′22″W, 1652 m, common on bark and wood of *Calocedrus decurrens*, 8.xii.2005, *K. Knudsen 4486 & R, Muertter* (UCR, det. by S. Altermann).

***Lichinella cribellifera* (Nyl.) P.P.Moreno & Egea SB**

FIG. 25B

NOTES. –. The species may be mistaken for *Lichinella nigritella*, but the sparsely branched, widely rounded, folded and plicate lobes with otherwise smooth surface are distinctive. Furthermore, it has a preference for more acidic substrata. *Lichinella cribellifera* is widespread in the southwestern North America, but had not yet been reported from the San Bernardino or San Jacinto Mountains. At Cactus Flat it was accompanied by *Peltula euploca* and *Phloeopeccania pulvinulina*. *Lichinella cribellifera* is often accompanied by *L. stipatula* Nyl., a widespread species in southwestern North America (Schultz 2005) which has not yet been recorded from San Bernardino and San Jacinto Mountains, but is expected to occur there.

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flat just SE of junction of Rd. 18 and Smarts Ranch Rd. (FR 3N03), rocky slope, 34°18'51"N 116°48'25"W, 1820 m, 29.ix.2009, on inclined granite boulders, *M. Schultz 16617a* (HBG); 34°18'57.3"N 116°48'20"W, 1805 m, 29.ix.2009, in steep water runoff on granite, *M. Schultz 16618a* (HBG).

***Lichinella nigritella* (Lettau) P.P.Moreno & Egea SB, SJ**

NOTES. – *Lichinella nigritella* is rare in the San Jacinto Mountains but frequent on the Mojave Desrt side of the San Bernardino Mountains where it is often abundant in seepage tracks. It is common in Joshua Tree National Park (Knudsen et al. 2013a). Samples growing on calcareous rock (e.g. *Schultz 16615)* may appear grayish pruinose due to lime dust cover. For photographs of the species refer to Sharnoff (2014) and Wirth et al. (2013).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, along Rd. 18 somewhat N of National Forest entrance, base of SE facing steep road cut, 34°20'31"N 116°50'26"W, 1475 m, 27.ix.2009, along marble rock clefts, *M. Schultz 16615* (HBG). RIVERSIDE CO.: San Jacinto Mountains, end of Morris Ranch Rd., rocky slope of East Canyon, 33°39'23"N 116°35'07"W, 1720 m, 28.ix.2009, in rock clefts of steep marble boulders, *M. Schultz 16622* (HBG).

***Lobothallia alphoplaca* (Wahlenb. *ex* Ach.) Hafellner SJ, SB**

NOTES. – In this paper, the concept of *Lobothallia alphoplaca* includes specimens that were included previously in *L. praeradiosa* (Nyl.) Hafellner (e.g., those cited by Knudsen et al. 2013a). It is uncertain if *L. praeradiosa* occurs in North America and we suspect that the name may be misapplied in the region where the genus needs further study. For a photograph of this species refer to Knudsen et al. (2013a) under the name *L. praeradiosa.*

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Thomas Mountain, 33°38′39″N 116°42′24″W, 1632 m, 5.ii.2004, on granite, *K. Knudsen et al. 859* (UCR).

Massalongia carnosa **(Dickson) Körber SB, SJ**

NOTES. – The small cyanolichen *Massalongia carnosa* is rare and occurs on soil in rock crevices in conifer forests in San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Snow Valley, 34°13′10″N 117°07′20″W, 1985 m, 1.xi.2013, on soil, *K. Knudsen 16253 & J. Kocourková* (UCR).

Megaspora verrucosa **(Ach.) Hafellner & V.Wirth SJ, SB**

NOTES. – *Megaspora verrucosa* is rare in the San Jacinto Mountains. It is known from a historical record from Seven Oaks in San Bernardino Mountains on *Abies concolor* collected and misdetermined as *Pertusaria wulfenii* DC. by H.E. Hasse in 1894 (FH!) (Hasse 1913). For photographs refer to Sharnoff (2014) and Wirth et al. (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50″N 116°44′23″W, 1576 m, on conifer bark, 9.v.2005, *K. Knudsen 2863 & J.C. Lendemer* (UCR).

Melanelixia californica **A.Crespo & Divakar SB, SJ**

NOTES. – *Melanelixia californica* is common in California. It is frequent in the San Jacinto Mountains and infrequent in the San Bernardino Mountains. The species occurs on *Quercus kelloggii,* on twigs and bark of *Abies concolor,* on *Alnus rhombifolia,* and on chaparral. In some cases in the San Bernardino Mountains it appears to be a pioneer of smooth bark where it grows before *Physconia* species become well established. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Cranston Station along San Jacinto River, 33°42′14″N 116°44′36″W, 1256 m, 23.i.2004, on *Arctostaphylos*, *K. Knudsen et al. 773* (UCR).

Melanelixia subargentifera **(Nyl.) O.Blanco SB, SJ**

NOTES. – *Melanelixia subargentifera* is rare in San Bernardino National Forest, where it is known from an old collection made by C.M. Wetmore from the Fuller Creek area in the San Jacinto Mountains and two recent collections from the San Bernardino Mountains (CNALH 2015). This species is frequent in the central and northern parts of California. Leavitt et al. (2016) suggest that specimens from western North America are the cryptic species *M. ahti* S. Leavitt, Essl., Divakar, A.Crespo, & Lumbsch but so far their sampling from western North America is not comprehensive. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, FS 1N05 to Fish Creek, 34°10′ 29″N 116°47′11″W, 2247 m, 7.x.2008, on granite in underhang, *J.C. Lendemer 14929 & K. Knudsen* (NY).

Melanohalea elegantula **(Nyl.) O.Blanco et al. SB**

NOTES. – *Melanohalea elegantula* is common on the desert side of San Bernardino Mountains at higher elevations, often occurring on *Cercocarpus ledifolius*. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, pebble plain along Polique Canyon Rd., 34°18′18"N 116°51′03"W, 2282 m, 25.viii.2011, on shredding bark of *Cercocarpus ledifolius*, *K. Knudsen et al. 13677* (UCR, hb. Esslinger).

Melanohalea columbiana **S. Leavitt, Essl., Divakar, A.Crespo, & Lumbsch SJ**

NOTES. – *Melanohalea columbiana* is rare in the San Jacinto Mountains where it occurs on the western slope in chaparral. This is a cryptic species that cannot be morphologically distinguished from *M. multispora* (A. Schneider) O. Blanco, A. Crespo, Divakar, Essl. & D. Hawksw. (Leavitt et al. 2016). For photographs refer to McCune and Geiser (2009) and Sharnoff (2014) as *M. multispora.*

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, off Burnt Valley Road, 33°43′59"N 116°36′06"W, 1451 m, 10.i.2008, on *Adenostoma sparsifolium* Torrey, *J.C. Lendemer 11408 & K. Knudsen* (NY).

Melanohalea subolivacea **(Nyl.) O. Blanco et al. SB, SJ**

NOTES. – *Melanohalea subolivacea* is common in the San Bernardino National Forest, often forming large beautiful thalli on the smooth bark of the scrub oak *Quercus berberidifolia*. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Hall Canyon, UC James Reserve, 33°48′44"N 116°46′20"W, 1702 m, 13.viii.2012, on twigs of scrub oak, *K. Knudsen 15074* (UCR).

Micarea denigrata **(Fr.) Hedlund SB, SJ**

NOTES. – *Micarea denigrata* is frequent on wood and bark on the northwestern side of the San Jacinto Mountains. It was collected on the wood of *Calocedrus decurrens* in the San Bernardino Mountains (*Knudsen 17560*, UCR). Some specimens have negative spot test reactions and TLC is required to detect the presence of gyrophoric acid.

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50"N 116°44′23"W, 1576 m, 9.v.2005, on rotten conifer log, *K. Knudsen 2675.2 & J.C. Lendemer* (ASU, UCR).

Miriquidica scotopholis **(Tuck.) B.D. Ryan & Timdal SB, SJ**

NOTES. – *Miriquidica scotopholis* is common in southern California and in San Bernardino National Forest. Specimens often cover a meter or more on granite, appear black at a distance, with apothecia lacking or rare, but are easily identified in the field by the brown squamulose-like areoles. For a photograph of a very fertile thallus see Sharnoff (2014). To see a photograph of the species forming a trimline at Lake Tahoe see Beyer (2015). Specimens produce miriquidic acid with usually four unknowns. For a description refer to Lendemer and Knudsen (2008a).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Thomas Mountain, 33°35′19"N, 116°37′57"W, 1451 m, 11.i.2008, on granite, *J.C. Lendemer 11374 & K. Knudsen* (NY).

Montanelia disjuncta **(Fries) Hedlund SB, SJ, SR**

NOTES. – In southern California, *Montanelia disjuncta* has a scattered distribution in San Bernardino National Forest at the high elevations. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, San Jacinto State Park, near Round Valley, 33°48′44"N 116°38′54"W, 2597 m, 2.vi.2013, on granite, *K. Knudsen 15827.1* (UCR).

Montanelia saximontana **(R, Anderson & W.A.Weber) S. Leavitt, Essl., Divakar, A.Crespo, & Lumbsch SB, SJ**

NOTES. – *Montanelia saximontana* is infrequent in the San Bernardino National Forest and more generally in southern California. This species is morphologically indistinguishable from the Asian *M. tominii* (Oskner) Divakar, A.Crespo, Wedin & Essl. and descriptions of *M. tominii* can be used for identification of California material (Leavitt et al. 2016). For photographs refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Fuller Ridge, 33°50′15″N 116°44′11″W, 2347 m, 2.x.2008, on granite, *J.C. Lendemer 14614 & K. Knudsen* (NY).

Myriolecis hagenii **(Ach.) Śliwa, Zhoa Xin & Lumbsch SJ**

NOTES. – This species is common in southern California, though we have only one collection from San Jacinto Mountains. This species is usually treated in the literature as *Lecanora hagenii* (Ach.) Ach but we follow Zhao et al. (2016) and treat it as *Myriolecis hagenii*. For a photograph and description refer to Śliwa (2007).

Specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, South Ridge, 33°44′10″N 116°42′07″W, 1875 m, 2.x.2008, on granite, *J.C. Lendemer14675 & K. Knudsen* (NY)

Myriolecis crenulata **(Hooker) Śliwa, Zhoa Xin & Lumbsch SB**

NOTES. – This species is common on calcareous rock in the San Bernardino Mountains. This species is usually treated in the literature as *Lecanora crenulata* Hooker but we follow Zhao et al. (2016) and treat it as *Myriolecis crenulata*. For photographs and a description refer to Śliwa (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′18″N 116°37′26″W, 1859 m, 7.vi.2005, on dolomite, *K. Knudsen 3310* (UCR).

Myriolecis dispersa **(Pers.) Śliwa, Zhoa Xin & Lumbsch SB, SJ**

NOTES. – This species is common throughout southern California. It can be confused with *L. hagenii*. This species is usually treated in the literature as *Lecanora dispersa* (Pers.) Sommerf. but we follow Zhao et al. (2016) and treat it as *Myriolecis dispersa*. For a photograph and description refer to Śliwa (2007)

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Keller Cliffs, 34°09′45″N 117°08′27″W, 1195 m, 2.i.2014, on granite rubble, *K. Knudsen et al. 16413* (UCR).

Myriolecis flowersiana **(H.Magn.) Śliwa, Zhoa Xin & Lumbsch SB**

NOTES. – This species is infrequent in the San Bernardino Mountains. This species is usually treated in the literature as *Lecanora flowersiana* H.Magn. but we follow Zhao et al. (2016) and treat it as *Myriolecis flowersiana*. For a photograph and a description refer to Śliwa (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Keller Cliffs, 34°09′45″N 117°08′27″ W, 1195 m, 2.i.2014, on quartz, *K. Knudsen et al. 16425* (UCR).

Myriospora scabrida **(Hedl. ex H.Magn.) K.Knudsen & L.Arcadia SJ**

NOTES. – *Myriospora scabrida* is rare in the San Jacinto Mountains on the coastal side and in California. For photograph see Nash et al. (2007) as *Acarospora scabrida* Hedl. *ex* H.Magn.

Selected specimen examined. **– U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Cedar Springs Trail, 33°39′52″N 116°34′36″W, 1980 m, 13.viii.2005, on schistose rock, *K. Knudsen 3494* (UCR).

Naetrocymbe saxicola **(A.Massal.) R.C.Harris SJ**

NOTES. – *Naetrocymbe saxicola* was reported new for North America from Yosemite National Forest (Lendemer et al. 2010). In the study area it was collected on calcareous rock on Rouse Ridge in the San Jacinto Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°43′27"N 116°49′53"W, 769 m, 7.iv.2006, on carbonate rock, *K. Knudsen 5718* (UCR).

Nodobryoria abbreviata **(Müll.Arg.) Common & Brodo SB, SJ**

NOTES. – This fruticose species was rare when it was collected in both the San Bernardino Mountains and San Jacinto Mountains by H.E. Hasse (Hasse 1906). He found it on only one *Pinus ponderosa* in the San Jacinto Mountains (Hasse 1906). It is still rare in San Jacinto Mountains today. A few individuals in the San Bernardino Mountains were observed on a lone pine by C. Wagner and K. Knudsen in 2004.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Devil's Slide, 33°46′26"N 116°40′38"W, 2354 m, 23.vii.2004, on *Pinus jeffreyi*, *K. Knudsen 1523* (UCR),

Normandina pulchella **(Borrer) Nyl. SJ**

NOTES. – This small species is rare in the northwestern San Jacinto Mountains. For a photograph of this species refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50"N, 116°44′41"W, 1576 m, 9.v.2005, on moss over boulder, *J.C. Lendemer 4143 & K. Knudsen* (NY, PH).

***Ochrolechia mahluensis* Räsänen SJ**

NOTES. – This sorediate crustose species was recently revised by Kukwa (2011) and we suspect that many earlier records of *O. androgyna* (Hoffm.) Arn. actually refer to this species. It is rare in the San Bernardino National Forest. For a description and photograph refer to Kukwa (2011).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50"N 116°44′41"W, 1576 m, 9.v.2004, on large rotting conifer stump, *J.C. Lendemer 4219 & K. Knudsen* (PH, UCR).

***Ochrolechia subpallescens* Verseghy SB**

NOTES. – This is the most common *Ochrolechia* species in southern California. Nonetheless the only record we have from the San Beranrdino Mountains is a collection made in 1973 from the Lake Arrowhead area. For a photograph of this species refer to Sharnoff (2014).

Specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 3 km S of Arrowhead Lake, 1550 meters, 24.ii.1973, on *Pseudotsuga macrocarpa, T.H. Nash 7087* (ASU, COLO [n.v.]).

***Parmelia barrenoae* Divakar, M.C.Molina & A.Crespo SB, SJ**

NOTES. – This recently described macrolichen is infrequent in the San Bernardino National Forest and has a scattered distribution in southern California. For description and photograph refer to Hodkinson et al. (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, gorge on N-slope along CA38, 34°09′31"N 116°56′26"W, 2124 m, on granite, 7.x.2008*, J.C. Lendemer 14973B & K. Knudsen* (NY; det. T. Esslinger).

***Parmelia hygrophila* Ahti & Goward SB**

NOTES. – This macrolichen is rare in the San Bernardino National Forest. For a photograph of this species refer to Brodo et al. (2001).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, gorge on N-slope along CA 38, 34°09′31"N 116°56′26"W, 2124 m, on granite, 7.x.2008*, J.C. Lendemer 14973A & K. Knudsen* (NY; det. T. Esslinger).

***Parmelia saxatilis* (L.) Ach. SB, SJ**

NOTES. – *Parmelia saxatilis* is common species in the Sierra Nevada Mountains but known from only a few locations in San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′13"N 116°44′06"W, 1576 m, 19.vi.2004, on granite boulders, *K. Knudsen 1462* (UCR).

***Parmelina coleae* Argüello & A.Crespo SB, SJ**

NOTES. – This beautiful gray macrolichen is known from only a few populations in the San Jacinto Mountains and one population in San Bernardino Mountains. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Mill Creek Canyon, 34°05′53"N 116°58′21"W, 1297 m, 5.iii.2014, on smooth bark of *Quercus berbedifolia* almost overgrown by *Physconia, K. Knudsen 16460 & A. Simmons* (UCR).

***Peccania cernohorskyi* (Servít) Czeika & Guttová SJ**

FIG. 26A

NOTES. – This is a small, but fairly distinctive cyanolichen described from thermophilous sites on crumbling diabase rocks in Central Bohemia. There are more records from Central Europe verified by one of us (MS) which await publication elsewhere. Recently, *Peccania cernohorskyi* has been reported to occur in Turkey (Candan & Schultz 2015), a record confirmed by molecular studies carried out in the course of a revision of whole genus which is still in progress. It seems that the species may have been overlooked or mistaken for similar Lichinaceae such as dwarfish forms of *Peccania coralloides* (A.Massal.) A.Massal. or *Anema tumidulum* Henssen *ex* P. M. Jørg., M. Schultz & Guttová. The sample

cited here collected on crumbling marble in the San Jacinto Mountains is small but fits all characteristics of the species such as the squamulose-peltate thallus with short, ± cylindrical to somewhat compressed lobes which become covered by globose isidia. Here, we report another record of this potentially widespread species from British Columbia, Canada, where it has been found on a thin soil crust over crumbling limestone.

Selected specimens examined. – **CANADA. BRITISH COLUMBIA.** Marble Canyon Provincial State Park, c. 30 km NNE of Lillooet, 50°50′N 121°40′W, 600 m, limestone outcrops, viii.1994, *B. McCune* 21835 (OSU). **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, end of Morris Ranch Rd., rocky slope of East Canyon, 33°39'23.8"N 116°35'07.2"W, 1720 m, on inclined marble boulders, 28.ix.2009, *M. Schultz & K. Knudsen 16621b* (HBG).

***Peccania corallina* Hazsl. SB**

FIG. 26B

NOTES. – This was somewhat surprising find since this species was hitherto only known from Slovakia. It is a poorly known species which certainly does not belong to the genus *Peccania* as the thallus anatomy deviates considerably and resembles *Anema* instead. It is a small cyanolichen that forms irregularly shaped, ascending to erect, somewhat elongated and flattened squamules or lobules with notched tips. The thallus cushions are very brittle and appear grayish due to the presence of pruina.

Selected specimens examined. – **U.S.A. CALIFORNIA.** BERNARDINO CO.: San Bernardino Mountains, along Rd. 18 somewhat N of National Forest entrance, base of SE facing steep road cut, 34°20'31"N 116°50'26"W, 1475 m, 27.ix.2009, along marble rock clefts, *M. Schultz 16616* (HBG). **SLOVAKIA.** PREŠOV REG. SABINOV DISTR.: Com. Saros [Sariš], in monte Vàrhegy prope págum Tarkö [Kamenica], *F. Hazslinszky 230* (BP, holotype!).

***Peccania tiruncula* (Nyl.) Henssen SJ**

NOTES. – A widespread, though rarely collected species in Mediterranean to desert biomes often occurring in calcareous rocky habitats but not avoiding sandstone or volcanic rock if site conditions are suitable. This species was collected at the same site as *Peccania cernohorskyi*. However, it differs from the latter in the narrower, shorter, more cylindrical and shortly furcate branches with smooth surface and in the absence of any isidia or granulose outgrowths. The present material matches samples collected by one of us (MS) in limestone areas in central Arizona very well. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, end of Morris Ranch Rd., rocky slope of East Canyon, 33°39'23"N 116°35'07'W, 1720 m, 28.ix.2009, on dust in small depression in inclined marble boulders, *M. Schultz 16621c* & *K. Knudsen* (HBG).

***Peltigera collina* (Ach.) Schrad. SB, SJ**

NOTES. – *Peltigera* species are rare in southern California. *Peltigera collina* is only known in San Bernardino National Forest from a few populations. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, gorge on N-slope along CA 38, 34°09'31"N, 116°56'26"W, 2124 m, 7.x.2008, on granite, *J.C. Lendemer 14995 & K. Knudsen* (NY).

***Peltigera didactyla* (With.) J.R.Laundon SB, SJ**

NOTES. – Like most members of the genus, *Peltigera didactyla* is rare in the San Jacinto Mountains, and southern California more generally. H.E. Hasse collected it in the San Bernardino Mountains. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Halfway Springs, 33°44′31"N, 116°47′11"W, 1034 m, 11.x.2008, on soil, *J.C. Lendemer 11494 & K. Knudsen* (NY).

***Peltigera extenuata* (Nyl. *ex* Vain.) Lojka SB**

NOTES. – *Peltigera extenuata* was collected enroute to the summit of San Gorgonio and is here reported new for California.

Figure 26. Photographs of selected species of San Bernardino National Forest lichens. Top: *Peccania cernohorskyi* (*Schultz 16621B*, HBG). Bottom: *Peccania corallina* (*Schultz 16616*, HBG). Photographs by Matthias Schultz (copyright, M. Schultz).

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge to San Gorgonio Mountain along Vivian Creek, 34°05′11"N 116°50′20" W, 19.vii.2015, 3051 m, *A.R. Pigniolo 788.2* (UCR)

***Peltigera praetextata* (Flörke *ex* Sommerf.) Zopf SJ**

NOTES. – *Peltigera praetextata* is rare in southern California and currently known from only a few collections made in the San Jacinto Mountains. H.E. Hasse collected it the San Gabriel Mountains. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, upper Rouse Ridge, 33°41′25"N, 116°47′41"W, 1169 m, 5.x.2008, on decomposing granite/mosses, *J.C. Lendemer 14769 & K. Knudsen* (DUKE, NY).

***Peltigera rufescens* (Weiss) Humb. SB, SJ**

NOTES. – This is the most common *Peltigera* species in southern California and in San Bernardino National Forest. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above truck trail to Fish Creek, 34°08′54"N 116°46′34" W, 2058 m, 23.xi.2014, on moss over granite outcrop, *K. Knudsen 17150* (UCR).

***Peltula bolanderi* (Tuck.) Wetmore SJ**

FIG. 27A (STERILE) AND 27B (FERTILE).

NOTES. – *Peltula bolanderi* was collected in Palm Canyon on the Sonoran side of the San Jacinto Mountains by C.M. Wetmore as well as on the west side at Soboba Hot Springs (CNALH 2015). It is frequent in southern California. For photographs refer to Nash et al. (2007) and Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Palm Canyon, 21.vi.1967, *C.M. Wetmore 16881C* (ASU, MIN[n.v.]).

***Peltula euploca* (Ach.) Poelt *ex* Ozenda & Clauzade SB, SJ**

FIG. 28A

NOTES. – This common cyanolichen occurs in drainages on non-calcareous rock and is common in southern California. It occurs in the San Jacinto Mountains and while it has not yet been collected in the San Bernardino Mountains where we expect it to occur.

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flat just SE of junction of Rd. 18 and Smarts Ranch Rd. (FR 3N03), rocky slope, 34°18′51″N 116°48′25″W, 1820 m, 29.ix.2009, on inclined granite boulders *M. Schultz 16617b* (HBG), 34°18'57"N 116°48'20"W, 1805 m, 29.ix.2009, in steep water runoff on granite, *M. Schultz 16618b* (HBG).

***Peltula michoacanensis* (B.de Lesd.) Wetmore SJ**

NOTES. – The only reports of this species from California are based on Wetmore's two collections, one from the San Jacinto Mountains above Palm Desert, the other from west side of the San Jacinto Mountains at Soboba Hot Springs. For a photograph of this species refer to Nash et al. (2007).

Selected reference specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, [San Bernardino National Forest,] above Palm Desert, elevation unknown, 17.vi.1966, on rock, *C.M. Wetmore 14595* (MIN[n.v.]).

***Peltula obscurans* var. *hassei* (Zahlbr.) Wetmore SJ**

NOTES. – This common species in California was collected many times in the San Jacinto Mountains by C.M. Wetmore during his classic study of *Heppia* and *Peltula* (Wetmore 1970). For a photograph of this species refer to Sharnoff (2014).

Selected reference specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, elevation unknown, northeast of junction of Highways 71 & 79, on rock, vi.1967, *C.M. Wetmore 16902* (MIN[n.v.])

Figure 27. Photographs of selected species of San Bernardino National Forest lichens. Top: sterile *Peltula bolanderi* (*Schultz 16611*, HBG). Bottom: fertile *Peltula bolanderi* (*Schultz 16538*, HBG). Photographs by Matthias Schultz (copyright, M. Schultz).

Peltula obscurans **(Nyl.) Gyeln. var.** ***obscurans*** **SJ**

NOTES. – This species is common in the Sonoran Desert in Arizona but is rare in southern California. Wetmore collected it on the Sonoran Desert interface of the San Jacinto Mountains and one of us (JCL) collected it on Rouse Ridge on west side of the San Jacinto Mountains. For a photograph of this species refer to Sharnoff (2014).

Selected reference specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, [San Bernardino National Forest,] above Palm Desert, elevation unknown, 17.vi.1966, on rock, *C.M. Wetmore 14577* (MIN[n.v.]).

Peltula omphaliza **(Nyl.) Wetmore SJ**

NOTES. – This is a small species that can be easily overlooked but still appears to be genuinely rare in southern California with reports from the Santa Monica Mountains and Channel Islands (SBBG, UCR). It was collected once in Palm Canyon on the Sonoran side of the San Jacinto Mountains. For photographs refer to Nash et al. (2007) and Sharnoff (2014).

Selected reference specimen. **–** **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, [San Bernardino National Forest,] Palm Canyon, elevation unknown, 20.vi.1966, on rock, *C.M. Wetmore 16850* (MIN[n.v.]).

Peltula patellata **(Bagl.) Swinscow & Krog SJ**

NOTES. – This species is common in biotic soil crusts in southern California. The first author (KK) collected it above Snow Creek, not far from Chino Canyon, in the Sonoran Desert interface of the San Jacinto Mountains. For photographs refer to Nash et al. (2007) and Sharnoff (2014).

Selected reference specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, [San Bernardino National Forest,] Chino Canyon, elevation unknown, 17.vi.1966, on soil, *C.M Wetmore 14621* (MIN[n.v.]).

Peltula zahlbruckneri **(Hasse) Wetmore SJ**

FIG. 28B

NOTES. – This species usually occurs on rock in drainages with seasonal water flow. It is known from two collections made by C.M. Wetmore on the Sonoran Desert side of the San Jacinto Mountains. For photographs refer to Nash et al. (2007) and Sharnoff (2014).

Selected reference specimen. **–** **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, [San Bernardino National Forest,] above Palm Desert, 17.iv.1966, on rock, *C.M. Wetmore 14591* (MIN[n.v.]).

Phaeophyscia ciliata **(Hoffm.) Moberg SJ**

NOTES. – This species is rare in southern California and occasional in Yosemite National Park (Hutten et al. 2013). For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′49"N 116°44′24"W, 1650 m, 8.x.2008, on granite, *J.C. Lendemer 14835 & K. Knudsen* (NY).

Phaeophyscia decolor **(Kashiw.) Essl. SB, SJ**

NOTES – This species has a scattered distribution in the San Jacinto Mountains and is rare in the San Bernardino Mountains. Elsewhere in southern Califronia it has been collected in the San Gabriel Mountains and on Palomar Mountain. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. **–** **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, SE of Reeds Meadow, 33°46′08"N 116°39′23"W, 2438 m, 10.vii.2006, on granite boulders in shade, *K. Knudsen 6848.1* (UCR).

Phaeophyscia hirsuta **(Mereschk.) Essl. SB, SJ**

NOTES. – *Phaeophyscia hirsuta* has a scattered distribution in the San Jacinto Mountains and the San Bernardino Mountains. It is common in southern California. For a photograph of this species refer to Sharnoff (2014).

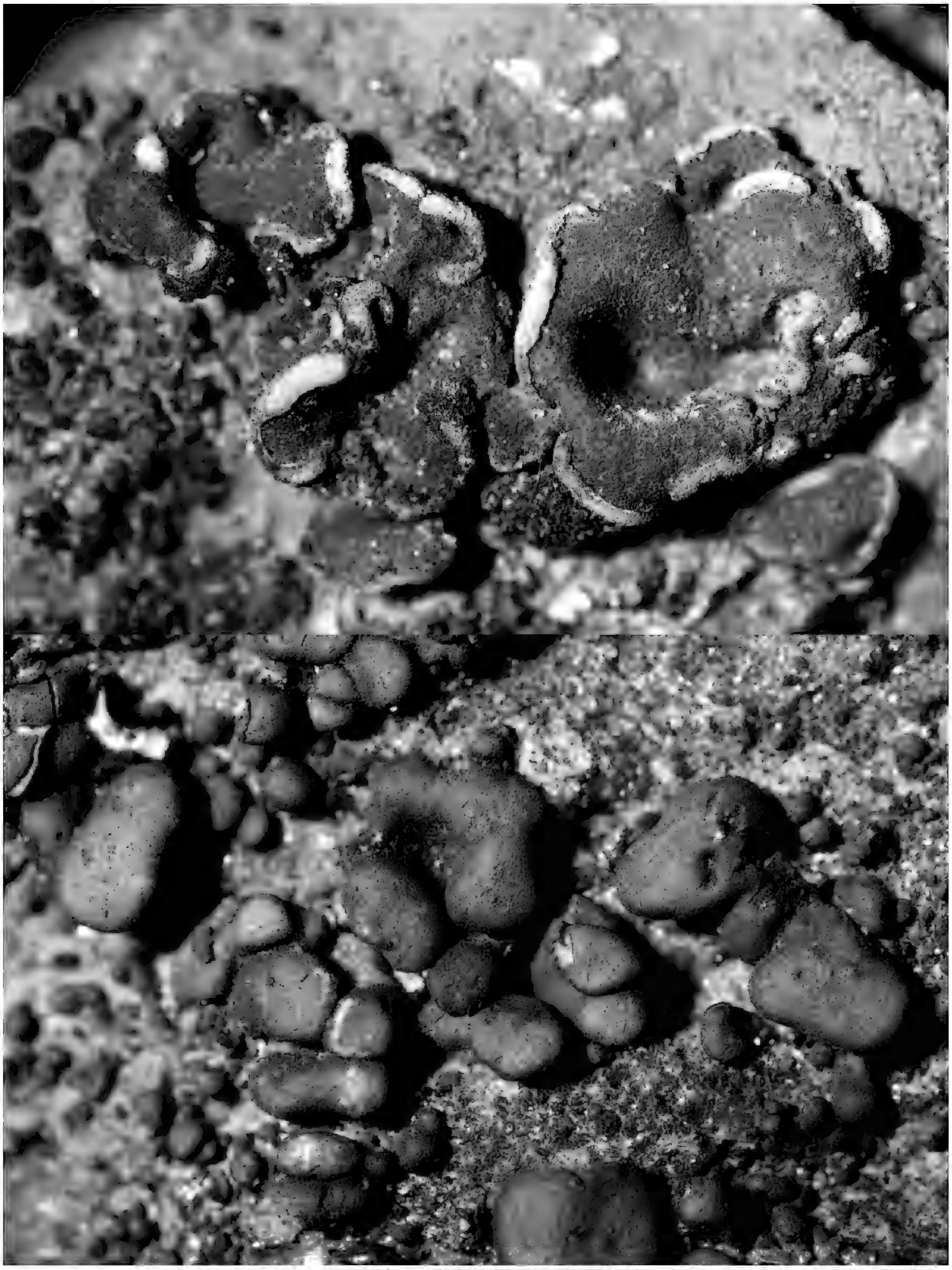

Figure 28. Photographs of selected species of San Bernardino National Forest lichens. Top: *Peltula euploca* (*Schultz 16610C*, HBG). Bottom: *Peltula zahlbruckneri* (*Schultz 16585C*, HBG). Photographs by Matthias Schultz (copyright, M. Schultz).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′12"N 116°47′27"W, 1902 m, 9.vi.2005, on moss over carbonate rock, *K. Knudsen 3669* (UCR, hb. Esslinger; det. T.E. Esslinger).

***Phaeophyscia orbicularis* (Neck.) Moberg SB, SJ**

NOTES. – *Phaeophyscia orbicularis* occurs in the San Jacinto Mountains and the San Bernardino Mountains. It is frequent in southern California but never locally abundant. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 1N09, 34°10′20"N 116°58′51"W, 1376 m, 25.vii.2015, on *Garrya* shrub, *J. Kocourková s.n. & K. Knudsen* (UCR).

***Phaeophyscia sciastra* (Ach.) Moberg SB**

NOTES. – *Phaeophyscia sciastra* is frequent in the mountains of the southwestern Mojave Desert and in the San Bernardino Mountains. It has usually very reduced thallus in these habitats. For photographs of typical, non-reduced specimens refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′18"N 116°47′15"W, 1887 m, 7.vi.2005, on hard carbonate rock, *K. Knudsen 3297 & M. Knudsen* (UCR).

***Phaeorrhiza sareptana* (Tomin) H.Mayrh. & Poelt SB**

NOTES. – *Phaeorrhiza sareptana* is known from a single collection made in the San Bernardino Mountains where it occurred in a biotic soil crust in a pinyon pine and juniper woodland. This is southern range extension from Sierra Nevada Mountains (Hutten et al. 2013). For a photograph of this species refer to McCune and Rosentreter (2007).

Specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge above Burns Canyon, 34°15′20"N 116°43′18"W. 2093 m, 5.xi.2014, in soil crusts over schistose rock in area mixed with limestone, *K. Knudsen et al. 17002* (SASK, SBBG, UCR; det. J.W. Sheard).

***Phloeopeccania pulvinulina* J.Steiner SB**

FIG. 29A

NOTES. – This is a widespread species in southwestern North America and northwestern Mexico occurring from lower to higher elevations on various rocky substrata often in seepage communities (Schultz & Büdel 2007). It is easily overlooked due to the scattered, small, minutely stalked and somewhat convex squamules. It often occurs in sterile state, but if fertile the usually polysporous asci are quite distinctive.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flat just SE of junction of Rd. 18 and Smarts Ranch Rd. (FR 3N03), 34°18'57"N 116°48'20"W, 1805 m, 29.ix.2009, in steep water runoff on granite, *M. Schultz 16618c* (HBG).

***Phlyctis argena* (Spreng.) Flot. SJ**

NOTES. – This sterile crust is rare in the San Jacinto Mountains and also occurs on Palomar Mountain in moist microhabitats on rock. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′49"N 116°44′24"W, 1650 m, 6.x.2008, on granite, *J.C. Lendemer 14819 & K. Knudsen* (NY).

***Physcia aipolia* (Ehrh. *ex* Humb.) Fürnr. SB, SJ**

NOTES. – *Physcia aipolia* is infrequent in San Bernardino National Forest and in southern California. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014). *Physcia alnophila* (Vain.) Loht. et al., which has recently been recognized as a segregate of *P. aipolia* (Lohtander et al. 2009), has not yet been identified from California.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, canyon near Hwy. 38 and Angelus Oak, 34°09′25"N 116°55′51"W, 1833 m, 3.xi.2013, on smooth bark of *Quercus kelloggii, K. Knudsen 16297.1 & J. Kocourková* (UCR).

***Physcia albinea* (Ach.) Nyl. SB**

NOTES. – This *Physcia* species is known in the San Bernardino Mountains from only a single collection determined by R. Moberg. The species was reported from further north in Yosemite National Park (Hutten et al. 2013).

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Onyx Summit, 2570 m, 9.viii.1975, on granite, *T.H. Nash III 11238* (ASU; det. R. Moberg).

***Physcia biziana* (A.Massal.) Zahlbr. SB, SJ**

NOTES. – *Physcia biziana* is common in southern California but it is apparently infrequent in San Bernardino National Forest. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, near top of Thomas Mountain, 33°35′57"N 116°38′41"W, 1729 m, 24.x.2003, on granite, *K. Knudsen 569.2 & K. Kramer* (UCR).

***Physcia caesia* (Hoffm.) Hampe ex Fürnr. SB, SJ**

NOTES. – In southern California *Physcia caesia* is a common montane species on granite. For photographs refer to Hinds and Hinds (2007), McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Snow Valley, 34°13′18"N 117°04′03"W, 1900 m, 10.vi.2015, on granite, *K. Knudsen 16686* (UCR).

***Physcia dimidiata* (Arnold) Nyl. SB, SJ**

NOTES. – *Physcia dimidiata* is common in southern California from the Channel Islands to the Mojave Desert. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Tahquitz Peak, 33°45′21"N 116°48′41"W, 2638 m, 4.x.2004, on granite, *K. Knudsen 1780.2* (UCR).

***Physcia dubia* (Hoffm.) Lettau SB**

NOTES. – *Physcia dubia* is infrequent in southern California and usually occurs in the mountains of the Mojave Desert. In the study area it is known only from the San Bernardino Mountains. For a photograph of this species refer to Hinds and Hinds (2007) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Onyx Summit, 34°12′29"N, 116°43′03"W, 2635 m, 7.x.2008, *J.C. Lendemer 14902 & K. Knudsen* (NY).

***Physcia stellaris* (L.) Nyl. SB, SJ**

NOTES. – *Physcia stellaris* has a scattered distribution in southern California and is most often collected on scrub oaks and chaparral. In the San Bernardino Mountains it was also collected on *Alnus rhombifolia*. For photographs refer to Hinds and Hinds (2007), McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, western slope, 33°41′52"N 116°45′13"W, 1229 m, 11.vii.2012, on scrub oaks, *K. Knudsen 15051.1* (UCR).

***Physcia subalbinea* Nyl. SJ**

NOTES. – *Physcia subalbinea* is only currently known in southern California from collections made in the San Jacinto Mountains and the San Gabriel Mountains. It is common in Sierra Nevada Mountains (Hutten et al. 2013).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50"N 116°44′41"W, 1576 m, 9.v.2004, on granite and moss, *J.C. Lendemer 4293 & K. Knudsen* (NY, UCR).

***Physcia tenella* (Scop.) DC. SB, SJ**

NOTES. – *Physcia tenella* is infrequent in San Bernardino National Forest and more generally in the southern California mountains. For photographs refer to Hinds and Hinds (2007), McCune and Geiser (2009) and Sharnoff (2014).

Figure 29. Photographs of selected species of San Bernardino National Forest lichens. Top: *Phloeopeccania pulvinulina* (*Schultz 16618C*, HBG; photograph by Matthias Schultz, copyright M. Schultz). Bottom: *Placopyrenium noxium* (*Knudsen 9421*, UCR; photograph by Tom Wheeler, copyright U.S. National Forest Service).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, northwest slope of East Canyon, 39°39′39"N, 116°35′11"W, 1572 m, 10.i.2008, on bark of *Quercus*, *J.C. Lendemer 11438 & K. Knudsen* (NY; det. T.L. Esslinger).

Physconia americana **Essl. SB**

NOTES. – *Physconia americana* grows near the summit of San Gorgonio in the San Bernardino Mountains. Otherwise it is rare in southern California. For a photograph of this species refer to Sharnoff (2014)

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge to San Gorgonio Mountain along Vivian Creek, 34°05′11"N 116°50′ 20"W, 3051 m, 19.vi.2015, on granite, *A.R. Pigniolo 776.1* (UCR)

Physconia californica **Essl. SB, SJ**

NOTES. – *Physconia californica* is infrequent in San Bernardino National Forest and often a minor member of corticolous communities. For photographs refer to Nash et al. (2007) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Mill Creek Canyon, 34°06′00"N 117°01′24"W, 1000 m, 5.iii.2014, on old bark *Salix*, *K. Knudsen 16450 & A. Simmons* (UCR).

Physconia enteroxantha **(Nyl.) Poelt SB, SJ**

NOTES. – *Physconia enteroxantha* is infrequent in San Bernardino National Forest. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, narrow canyon bottom, 34°13′35"N 116°40′22"W, 1873 m, 10.x.2014, on *Juniperus*, *K. Knudsen 17243 & M. Crawford* (UCR).

Physconia fallax **Essl. SB, SJ**

NOTES. – *Physconia fallax* is infrequent in San Bernardino National Forest like several other *Physconia* species.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Dollar Lake, 34°07′22"N 116°51′11"W, 2678 m, 6.vii.2012, on moss, *J. Kocourková s.n. & K. Knudsen* (UCR).

Physconia isidiigera **(Zahlbr. ex Herre) Essl. SB, SJ**

NOTES. – *Physconia isidiigera* is the most common *Physconia* in southern California and is common in San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Keller Cliffs, 34°09′45"N 117°08′27"W, 1195 m, 3.i.2014, on base of dead shrub, *K. Knudsen et al. 16415* (UCR).

Physconia leucoleiptes **(Tuck.) Essl. SB, SJ**

NOTES. – *Physconia leucoleiptes* is rare in the San Bernardino and San Jacinto Mountains. For a photograph of this species refer to Hinds and Hinds (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Hall Canyon, UC James Reserve, 34°09′45"N 117°08′27"W, 1705 m, 13.viii.2012, on *Quercus* bark, *K. Knudsen 15072.1* (UCR).

Physconia muscigena **(Ach.) Poelt SB, SJ**

NOTES. – *Physconia muscigena* is infrequent in San Bernardino National Forest where it usually occurs with moss on soil or on decaying granite or gravel. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Lily Rock, 33°45′37"N 116°41′06"W, 2243 m, 21.vii.2004, on decaying granite, mosses and soil, *K. Knudsen 1466* (UCR)

***Physconia perisidiosa* (Erichsen) Moberg SB, SJ**

NOTES. – *Physconia perisidiosa* is frequent in San Bernardino National Forest, where it usually occurs on granite in shady microhabitats and rarely on bark. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Thomas Mountain, 33°38′39"N 116°42′24"W, 1644 m, 5.x.2008on granite, *J.C. Lendemer 14834 & K. Knudsen* (NY).

***Placidium acarosporoides* (Zahlbr.) Breuss SB, SJ**

NOTES – This *Placidium* occurs on rock and looks more like *Heteroplacidium compactum* than an *Acarospora* in the field. It is common in the Mojave Desert and was collected by H.E. Hasse in Palm Springs on the Sonoran interface of the San Jacinto Mountains. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′16"N 116°47′16"W, 1869 m, 7.vi.2005, on soft granite in drainage, *K. Knudsen 3324* (UCR; det. O. Breuss).

***Placidium californicum* Breuss SJ**

NOTES. – *Placidium californicum* has a strong preference for calcareous soils as a substrate. It is rare in the San Jacinto Mountains and was described from San Nicolas Island (Breuss & Bratt 2000). It resembles *P. squamulosum* but has larger ascospores.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rouse Ridge, 33°42′49"N 116°49′08"W, 1037 m, 5.ii.2004, in biological soil crust on fine soil in full sun, *K. Knudsen et. al. 841.2* (UCR; verif. O. Breuss).

***Placidium pilosellum* (Breuss) Breuss SJ**

NOTES. – *Placidium pilosellum* is rare in California, with records from the southern California desert and the Channel Islands (Breuss & Bratt 2000). In the study area it is known from one record from the San Jacinto Mountains. One of the most distinctive characters of the species is marginal pycnidia.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, NE of junction of Hwy. 79 and Hwy. 71, elevation not stated, 22.vi.1967, on soil, *C.M. Wetmore 16909* (MIN; det. O. Breuss).

***Placidium squamulosum* (Ach.) Breuss SB, SJ**

NOTES. – *Placidium squamulosum* is common in biotic soil crusts in southern California and in San Bernardino National Forest. For photographs refer to McCune and Rosentreter (2007) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Dollar Lake, 34°07′26"N 116°51′25"W, 2678 m, 5.vii.2012, in biological soil crusts, *K. Knudsen 14692 & J. Kocourková* (UCR).

***Placocarpus americanus* K.Knudsen, Breuss & Kocourk. SB**

NOTES. – This species begins as a juvenile parasite on *Protoparmeliopsis garvaglioli* (Körber) Arup, Zhao Xin & Lumbsch, *P. muralis*, and *Rhizoplaca chrysoleuca* and often develops an independent gray lichenized thallus (Knudsen et al. 2009, 2013a). Although originally described from North America it was recently reported new for Russia (Zhurbenko & Nortov 2015).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, IN02; Burns Canyon, 34°13'55"N 116°40'56"W, 1998 m, 5.xi.2014, on *Rhizoplaca chrysoleuca* on rock, *J. Kocourková et al. 8551* (hb. K & K).

***Placopyrenium noxium* Breuss SB**

FIG. 29B

NOTES. – This species looks similar to *Verrucaria bernardensis*, which is common in the Mojave Desert and at Cactus Flats in the San Bernardino Mountains. Nonetheless *Placopyrenium noxium* is rare in the San Bernardino Mountains and is otherwise known in southern California from single

populations in the Santa Ana Mountains and the Santa Monica Mountains (Breuss 2009, Knudsen & Kocourková 2009b).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′26"N 116°47′32"W, 1838 m, 20.xii.2004, on limestone rubble, *K. Knudsen 2089 & C.L. Wagner* (LI, UCR; det. O. Breuss).

Placopyrenium stanfordii **(Herre) K.Knudsen SJ**

NOTES. – This species is frequent in central California but rare in both southern California and the San Jacinto Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, above Snow Creek, 33°52′29"N 116°40′54"W, 574 m, 15.xii.2003, on granite, *K. Knudsen 736 & K. Kramer* (UCR; det. Breuss).

Placynthiella dasaea **(Stirt.) Tønsberg SB**

NOTES. – This is a southern range extension for *Placynthiella dasaea*. The nearest known location is an isolated population in riprarian woodland in Coon Creek in Montana de Oro State Park in San Luis Obispo County (Knudsen & Kocourková 2010a). The population cited below was destroyed in the fire of 2015. Thus it may have been extirpated in southern California.

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above dirt road to Fish Creek, 34°08′53"N 117°46′19"W, 2167 m, 23.xi.2014, on wood of rotting confer log, *K. Knudsen 17173* (NY, SBBG, UCR; det. J.C. Lendemer).

Placynthiella icmalea **(Ach.) Coppins & P.James SB, SJ**

NOTES. – *Placynthiella icmalea* is rare in San Bernardino National Forest where it typically occurs in biotic soil crusts. For a photograph of this species refer to McCune and Rosentreter (2007)

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, along Hwy. 138, W of Burnt Mill Canyon, 34°16′25"N 117°19′07"W, 1107 m, 15.xi.2014, in biotic soil crust, *K. Knudsen 17040 & J. Kocourková* (UCR).

Placynthiella oligotropha **(J.R.Laundon) Coppins &P.James SB, SJ**

NOTES. – *Placynthiella oligotropha* is rare in San Bernardino National Forest where it occurs in biotic soil crusts. This species becomes more common at higher latitudes and is likely naturally rare in southern California. For photographs refer to McCune and Rosentreter (2007) and Wirth et al. (2013).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Dollar Lake, 34°07′22"N 116°51′11"W, 2678 m, 6.vi.2012, in biotic soil crust among *Sedum, J. Kocourková 8745 & K. Knudsen* (SBBG, UCR).

Placynthiella uliginosa **(Schrad.) Coppins & P.James SB, SJ**

NOTES. – *Placynthiella uliginosa* is rare in San Bernardino National Forest and has a scattered distribution in southern California. For a photograph of this species refer to McCune and Rosentreter (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Mill Creek Canyon, on shelf above Mill Creek, 34°06′00"N 117°01′24"W, 1000 m, 5.iii.2014, on granite-derived soil in biological soil crust, *K. Knudsen 16445 & A. Simmons* (UCR).

Placynthium nigrum **(Huds.) Gray SJ**

NOTES. – This effigurate cyanolichen is a calciphile and we suspect it is naturally rare in southern California. It is rare in San Bernardino National Forest, known currently only from Rouse Ridge. For photographs of this species refer to Wirth et al. (2013) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°42′42"N 116°43′6"W, 989 m, 5.x.2008, on calcareous pebble, *J.C. Lendemer 14764 & K. Knudsen* (NY).

***Pleopsidium flavum* (Bellardi) Körber SB, SJ, SR**

NOTES. – This bright yellow effigurate lichen is common at higher elevations throughout southern California, usually occurring on vertical rock surfaces on hard granite. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, below Onyx Summit, 34°12′08"N 116°45′08"W, 2439 m, 16.ix.2004, on hard granite, *K. Knudsen 1710* (UCR).

***Polycauliona nashii* (Nav.-Ros., Gaya & Hladún) Arup, Frödén & Søchting SB, SJ**

NOTES. – This is a common endolithic crustose species in southern California. For a photograph of this species refer to Knudsen et al. (2013a). Previously it has been referred to as *Caloplaca nashii* Nav.-Ros., Gaya & Hladún, however we follow Arup et al. (2013) in treating it in the genus *Polycauliona.*

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rattlesnake Canyon, 34°13′51"N 116°39′36"W, 1803 m, 10.xii.2014*, *K. Knudsen 17208 & M. Crawford* (UCR).

***Polycauliona polycarpa* (Hoffm.) Frödén, Arup & Søchting SB, SJ**

NOTES. – This is a common corticolous species in California and is frequent in the San Bernardino National Forest. For photographs refer to Hinds & Hinds (2007), McCune and Geiser (2009) and Sharnoff (2014). Previously it has been referred to as *Xanthoria polycarpa* (Hoffm.) Rieber, however we follow Arup et al. (2013) in treating it in the genus *Polycauliona.*

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rim of the World, 34°13′56"N 117°12′56"W, 1741 m, 10.vi.2014, on *Quercus kelloggii*, *K. Knudsen 16878* (UCR).

***Polycauliona stellata* (Wetmore & Kärnefelt) Arup, Frödén & Søchting SB, SJ**

NOTES. – *Polycauliona stellata* is infrequent in San Bernardino National Forest and occurs on rock. The thallus sometimes breaks down into a leprose crust, a character that can cause confusion with other sorediate species of *Caloplaca* s.l. The collection below is the only lichen collection in California on a Joshua tree, *Yucca brevifolia* Engelm. Previously it has been referred to as *Caloplaca stellata* Wetmore & Kärnefelt, however we follow Arup et al. (2013) in treating it in the genus *Polycauliona.*

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, pinyon pine woodland on slope above Cactus Flats, 34°18′12"N 116°48′10"W, 1905 m, 8.vi.2014, on woody base of *Yucca brevifolia*, *K. Knudsen 16816* (UCR).

***Protoparmelia badia* (Hoffm.) Hafellner SR**

NOTES. – This common montane species of Europe is currently only known from the San Bernardino National Forest from a single collection made on Santa Rosa Mountain. It is rare in southern California. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Rosa Mountain, 33°32′14"N, 116°18′12"N, 2214 m, 8.x.2008, on granite, *J.C. Lendemer 14989 & K. Knudsen* (UCR).

***Protoparmeliopsis muralis* (Schreb.) Choisy SB, SJ**

NOTES. – This is a common species on granite throughout southern California, including the Mojave Desert in Joshua Tree National Park. It occurs up to about 1828 meters elevation in San Bernardino National Forest. In North American literature, it is usually treated as *Lecanora muralis* (Schreb.) Rebenh. But we follow Zhao et al. (2016) treating it as *Protoparmeliopsis murlis*. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rattlesnake Canyon, 34°14′01″N 116°38′56″W, 1769 m, 10.xii.2014, on granite, *K. Knudsen 17212 & M. Crawford* (UCR).

***Pseudephebe minuscula* (Nyl. *ex* Arnold) Brodo & D.Hawksw. SB**

NOTES. – In the study area this species is common on San Gorgonio Summit. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio Peak, 34°05′57"N 116°49′28"W, 3499 m, 19.vii.2015, on granite, *A.R. Pigniolo 796* (UCR).

Pseudephebe pubescens **(L.) M.Choisy SB, SJ**

NOTES. – This montane species is rare in San Bernardino National Forest and occurs at lower elevations than *P. minuscula*. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Rainbow Lane and Hwy. 38, 34°10′22"N 116°43′05"W, 2439 m, 3.xi.2013, on granite, *J. Kocourková s.n. & K. Knudsen* (UCR).

Psora californica **Timdal SJ**

NOTES. – This species is common in California but rare in biotic soil crusts on the west slope of the San Jacinto Mountains. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, at junction of San Jacinto River and Hwy. 74, 33°42′48"N 116°46′39"W, 930 m, 11.xi.2003, on soil among mosses, *K. Knudsen 641* (UCR).

Psora crenata **(Taylor) Reinke SJ**

NOTES. – *Psora crenata* is rare in southern California. It occurs on the Sonoran interface of the San Jacinto Mountains in biotic soil crusts. For a photograph of this species refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Chino Canyon, 420 m, 10.x1.1998, on soil, *C. Bratt & E. Timdal s.n.* (O, SBBG).

Psora decipiens **(Hedw.) Hoffm. SJ**

NOTES. – This conspicuous *Psora* species is common in southern California but is only rarely locally abundant. It is rare in San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°43′27"N 116°49′53"W, 769 m, 7.iv.2006, in vertical soil crust on calcareous soil, *K. Knudsen 5732* (UCR).

Psora globifera **(Ach.) A.Massal. SB**

NOTES. – This species is rare in southern California and the San Bernardino National Forest. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Rainbow Lane and Hwy. 38, 34°10′22"N 116°43′05"W, 2439 m, 3.xi.2013, in montane soil crust, *K. Knudsen 16275 & J. Kocourková* (UCR).

Psora luridella **(Tuck.) Fink SJ**

FIG. 30A

NOTES. – This is the most common *Psora* species in cismontane southern California and often occurs on rock. It is frequent in the San Jacinto Mountains on the west slope.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Garner Valley, 33°37′54"N 116°37′54"W, 1375 m, 28.v.2004, in biotic soil crusts, *K. Knudsen 1199 & K. Kramer* (UCR).

Psora nipponica **(Zahlbr.) Gotth.Schneider SB, SJ. SR**

NOTES. – This common montane species is usually found on decaying granite among mosses. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above dirt road to Fish Creek, 34°08′54"N 116°46′34"W, 2058 m, 23.xi.2014, on moss over granite boulder, *K. Knudsen 17148* (UCR).

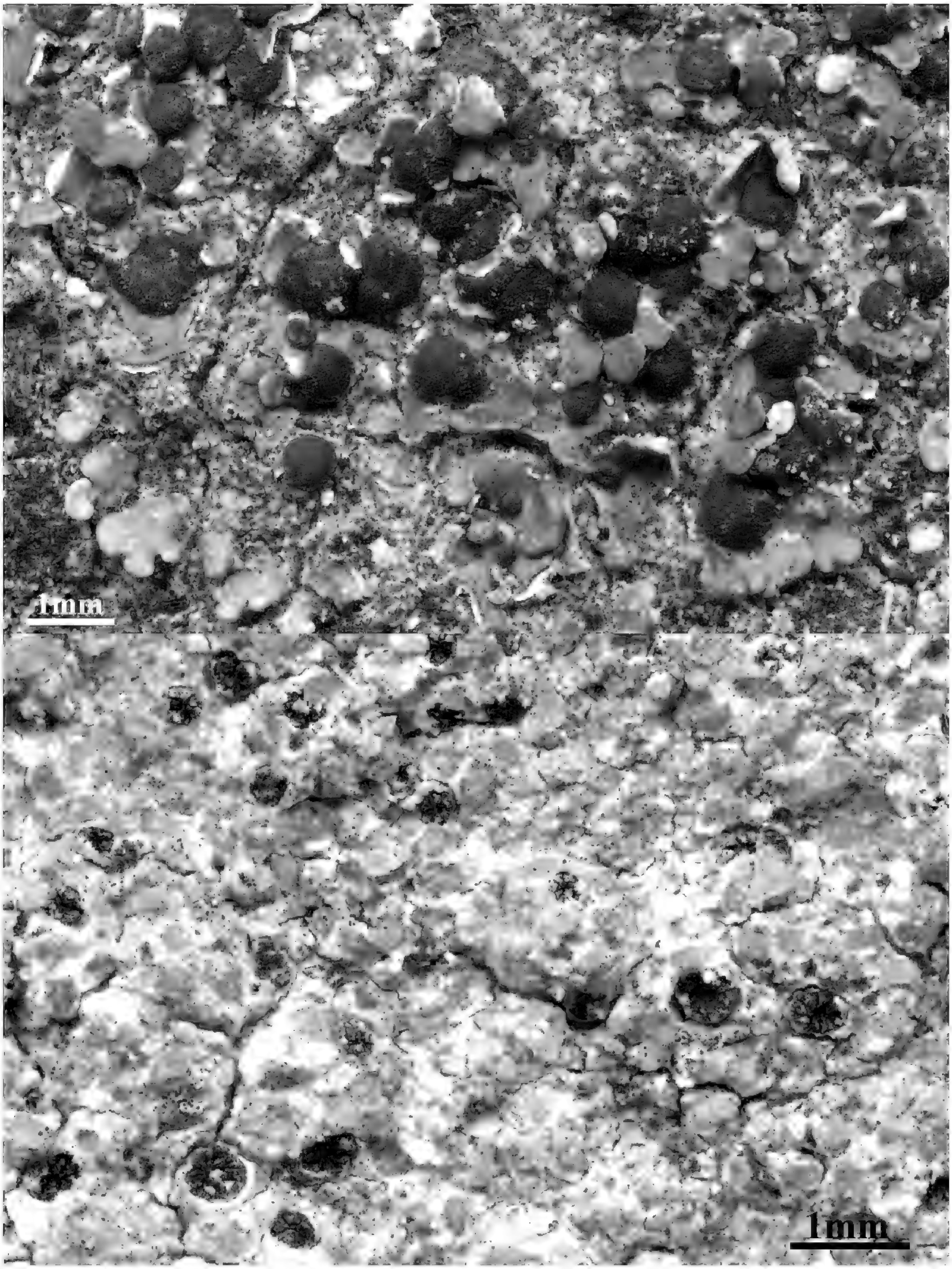

Figure 30. Photographs of selected species of San Bernardino National Forest lichens. Top: *Psora luridella* (*Knudsen 14495*, UCR). Bottom: *Ramonia ablephora* (*Knudsen 11734*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Psora pacifica* Timdal SJ**

NOTES. – This is a coastal species and was described from Santa Cruz Island. Like several coastal species (see *Dimelaena radiata*) it extends inland through the Santa Ana Mountains, Lake Elsinore and Perris to Rouse Ridge in the San Jacinto Mountains, where it is rare (CNALH 2015; Lendemer et al. 2009). For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°43′06"N, 116°43′17"W, 803 m, 5.x.2008, on calcareous pebble, *J.C. Lendemer 14740 & K. Knudsen* (NY).

***Psora russellii* (Tuck.) A.Schneider SJ**

NOTES. – This species is only known from the San Jacinto Mountains in the Sonoran Desert interface. It is an infrequent species in southern California. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, along State Hwy. 74, S of Palm Desert, near base of Seven Level Hill, 530 m, 21.iii.1998, *E. Timdal s.n.* (O).

***Psora tuckermanii* R.A.Anderson *ex* Timdal SJ, SB**

NOTES. – This is a common desert species that usually grows on rock, and was collected twice by C.M. Wetmore in the San Jacinto Mountains (including Chino Canyon). It is frequent in the San Bernardino Mountains. For photographs refer to Knudsen et al. (2013a and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′18"N 116°37′26"W, 1838 m, 7.xi.2004, on soil in crevices in limestone, *K. Knudsen 3303* (UCR).

***Psorotichia hassei* Fink *ex* J.Hedrick SB, SJ**

NOTES. – This cyanolichen was originally described from a collection made by H.E. Hasse in Strawberry Valley in the San Jacinto Mountains and the type at FH is preserved in a matchbox (FH!). It is rare in San Bernardino National Forest. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, plateau below Santa Rosa Mountain, 33°38′48"N 116°24′04"W, 762 m, 30.x.2004, on underside of large granite boulder, *K. Knudsen 2003 & B. Owe-Larsson* (UCR).

***Psorotichia vermiculata* (Nyl.) Forssell SB**

NOTES. – This is a new record for California and North America. The species taxonomy is poorly understood. Originally described from limestone rocks in Hungary, the species has recently been recorded from Alvar areas in Gotland, Sweden (Prieto et al. 2015). Two more records exist, one from a midelevation in lower Austria (Breuss 2010), the other from high altitude karst areas in the French Alps near Chamonix (Prieto et al. 2015). The identification of crustose Lichinaceae is notoriously difficult. Fortunately, the Cactus Flat material had several apothecia which allowed comparison with the few other fertile samples of this species that exist so far.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flat SE of junction of Rd. 18 and Smarts Ranch Rd. (FR 3N03), rocky slope, 34°18'16"N 116°47'55"W, 1860 m, 27.ix.2009, on NW-exposed marble boulders, *M. Schultz 16619b* (HBG).

***Ramonia ablephora* (Nyl. *ex* Hasse) R.C.Harris SJ**

FIG. 30B

NOTES. – This is a rare species recently rediscovered on Rouse Ridge in the San Jacinto Mountains (Lendemer et al. 2009). It was originally described from the inland side of the Santa Monica Mountains where it is rare on sandstone (Knudsen & Kocourková 2010c)

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°43′06"N, 116°43′17"W, 803 m, 5.x.2008, on shaded sandy soil in biological soil crust, *J.C. Lendemer 14747 & K. Knudsen* (NY, UCR).

***Ramonia gyalectiformis* (Zahlbr.) Vězda SJ**

FIG. 31A

NOTES. – This species is infrequent in southern California and occurs in both the Mojave and Sonoran Deserts (Knudsen et al. 2013a, Knudsen & Lendemer 2007). It is rare in the San Jacinto Mountains where it was originally described from the base of range in the Sonoran Desert (Hasse 1913).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, above Hwy. 74, below Pinon Flats past the Vista Point, 33°35′59"N 116°25′20"W, 1105 m, 25.ii.2010, on granite, *Knudsen et al. 11863* (UCR).

***Ramonia vermispora* Lendemer & K.Knudsen SJ**

NOTES. – This species is currently only known from its type locality on Thomas Mountain in the San Jacinto Mountains. For a description and photographs refer to Lendemer and Knudsen (2008b).

Selected specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Thomas Mountain, 33°35′36"N, 116°38′16"W, 1655 m, 11.i.2008, on shaded granite, *J.C. Lendemer 11377 & K. Knudsen* (NY).

***Rhizocarpon badioatrum* (Flörke *ex* Spreng.) Th.Fr. SB**

FIG. 31B

NOTES. – This species is common on granite in the San Bernardino Mountains. For a photograph of this species refer to Wirth et al. (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Holcomb Valley, 34°18′11"N 116°52′45"W, 2120 m, 18.xi.2014, on granite boulder, *K. Knudsen 17271 & J. Kocourková* (UCR).

***Rhizocarpon bolanderi* (Tuck.) Herre SB, SJ**

NOTES. – This species is common in the San Bernardino National Forest and more generally in the California mountains. The only known population of this species in Europe occurs in Norway (Westberg et al. 2015b). For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge to San Gorgonio Peak, 34°05′11"N 116°50′20"W, 3051 m, 19.vii.2015, on granite, *A.R. Pigniolo 782.1* (UCR).

***Rhizocarpon dimelaenae* Timdal SB, SR**

FIG. 32A

NOTES. – *Rhizocarpon dimelaenae* is a lichenicolous lichen that grows on *Dimelaena oreina.* The type locality is Jacoby Canyon in the San Bernardino Mountains. It is rare in San Bernardino National Forest.

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Rosa Mountain, 33°32′07"N 116°27′41"W, 2426 m, 18.vii.2009, on granite and *Dimelaena oreina*, *K. Knudsen et al. 11492* (NY, O, UCR).

***Rhizocarpon disporum* Th.Fr. SB, SJ**

NOTES. – *Rhizocarpon disporum* is common in San Bernardino National Forest, especially in the San Bernardino Mountains. For photographs refer to Wirth et al. (2013) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge to San Gorgonio Peak, 34°05′11"N 116°50′20"W, 3051 m, 19.vii.2015, on granite, *A.R. Pigniolo 776.2* (UCR).

***Rhizocarpon distinctum* Th.Fr. SB**

NOTES. – *Rhizocarpon distinctum* is rare in southern California. For a photograph of this species refer to Wirth et al. (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, gorge along Hwy. 38, 34°09′31"N, 116°56′26"W, 2124 m, 7.x.2008, on granite, *J.C. Lendemer 14965 & K. Knudsen* (UCR).

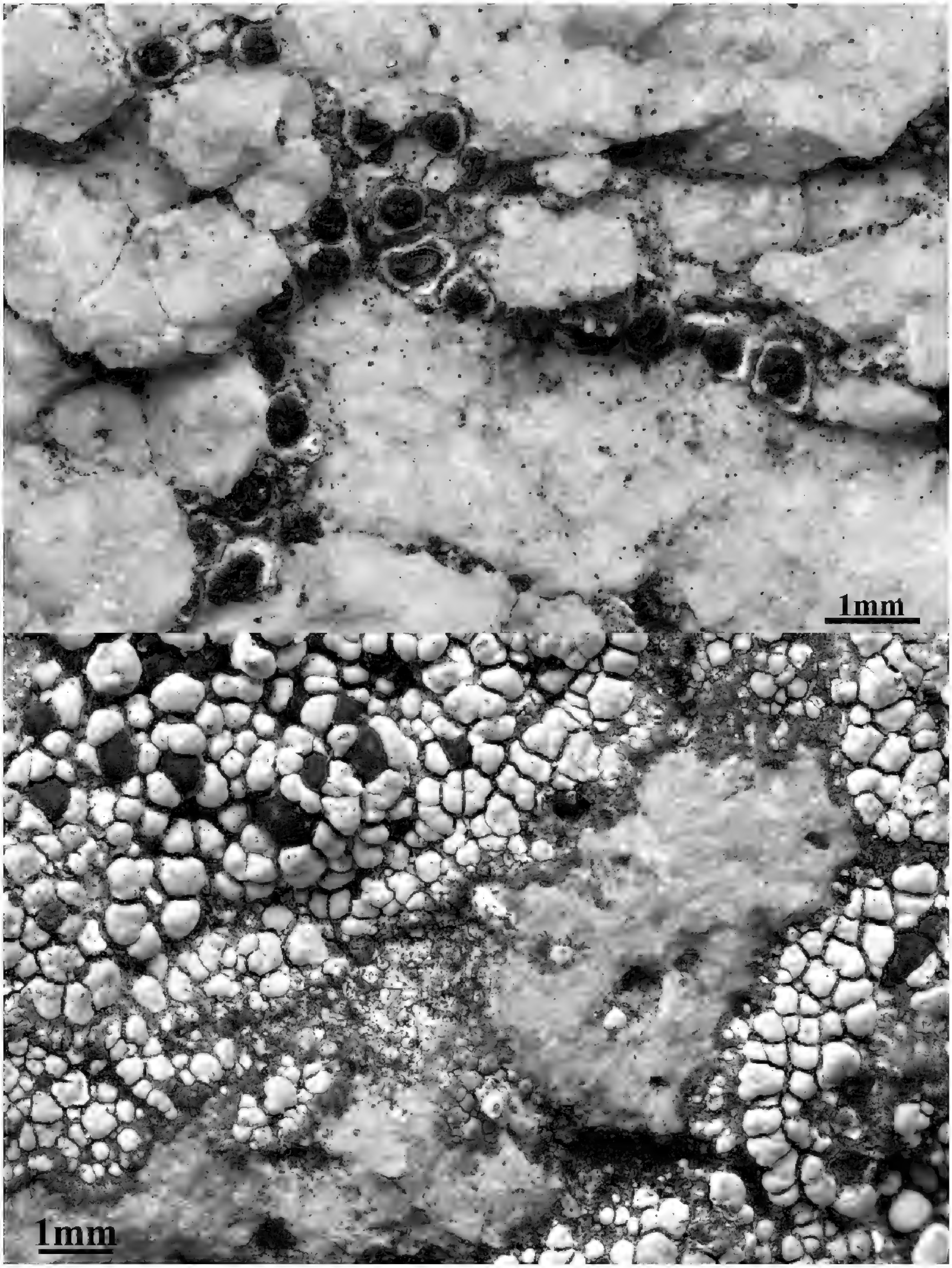

Figure 31. Photographs of selected species of San Bernardino National Forest lichens. Top: *Ramonia gyalectiformis* (*Knudsen 15138*, UCR). Bottom: *Rhizocarpon badioatrum* (*Knudsen 17271*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Rhizocarpon effiguratum* (Anzi) Th.Fr. SR**

FIG. 32B

NOTES. – *Rhizocarpon effiguratum* is rare in California where it is known from San Bernardino National Forest and Tioga Pass in Inyo National Forest (Hutten et al. 2013). It is a lichenicolous lichen on *Pleopsidium flavum*.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Rosa Mountain, 33°32′11"N 116°27′24"W, 2416 m, 18.vii.2009, on granite and *Dimelaena oreina*, *K. Knudsen et al. 11499* (UCR).

***Rhizocarpon eupetraeum* (Nyl.) Arnold SB**

NOTES. – This species is rare in San Bernardino Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Holcomb Valley, 34°18′37"N 116°53′58"W, 2129 m, 18.xi.2014, on granite boulders, *K. Knudsen 17087 & J. Kocourková* (UCR).

***Rhizocarpon geminatum* Körber SB, SJ**

NOTES. – *Rhizocarpon geminatum* is common in San Bernardino National Forest. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Black Mountain, 33°49′28"N 116°45′30"W, 236 m, 22.ix.2003, on granite, *Knudsen et al. 493* (UCR).

***Rhizocarpon geographicum* (L.) DC. SB, SJ**

NOTES. – One of three common yellow members of the genus with muriform ascospores in the San Bernardino National Forest, all that look similar in field. It occurs on San Jacinto Peak and San Gorgonio Peak. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. –**U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio Peak, 34°06′00"N 116°50′11"W, 3409 m, 12.ix.2015, on granite, *A.R. Pigniolo 865* (UCR).

***Rhizocarpon grande* (Flörke *ex* Flot.) Arnold SB, SJ**

NOTES. – This species is infrequent in San Bernardino National Forest. For a photograph of this species refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Mount San Jacinto State Park, Round Valley area, 33°48′44"N 116°38′54"W 2597 m, 3.vi.2013, on granite boulders, *K. Knudsen 15830* (UCR).

***Rhizocarpon lecanorinum* Anders SB**

NOTES. – This species is common in the Sierra Nevada Mountains but is rare in the San Bernardino Mountains (Hutten et al. 2013). For photographs refer to Sharnoff (2014) and Wirth et al. (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Snow Valley, 34°13′26"N 117°03′24"W, 2007 m, 10.vi.2014, on granite, *K. Knudsen 16905* (UCR).

***Rhizocarpon macrosporum* Räsänen SB, SJ**

NOTES. – One of three common yellow species with muriform ascospores common in San Bernardino National Forest, all that look similar in field. For a photograph of this species refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Fuller Ridge, 33°49′47"N 116°43′10"W, 2129 m, 1.x.2003, on granite, *K. Knudsen 519 & K. Kramer* (UCR).

***Rhizocarpon riparium* Räsänen SB, SJ**

NOTES. – One of three common yellow species with muriform ascospores common in San Bernardino NF, all that look similar in field. But of the three *R. riparium* is especially abundant in the San Bernardino Mountains. For a photograph of this species refer to Sharnoff (2014).

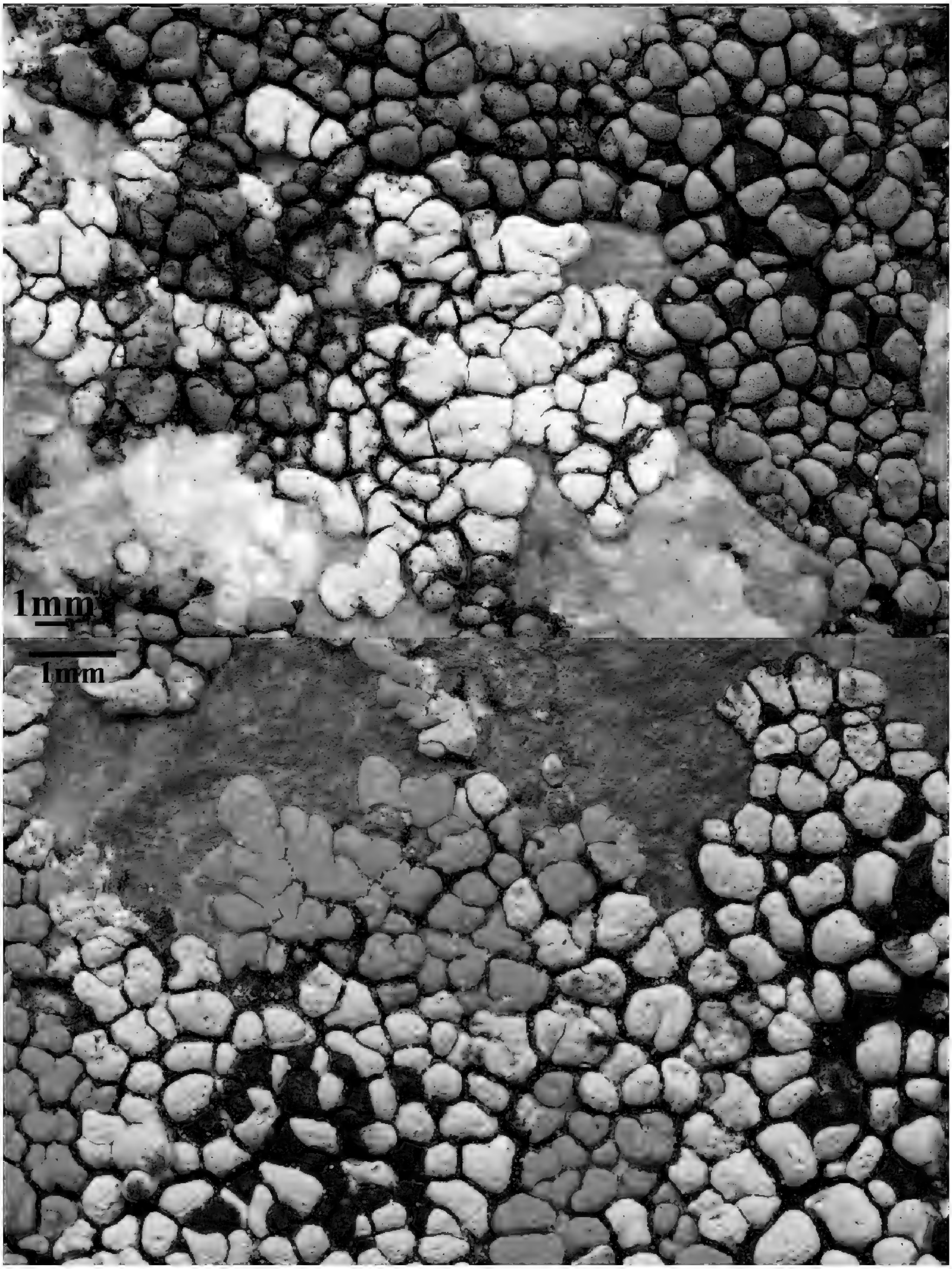

Figure 32. Photographs of selected species of San Bernardino National Forest lichens. Top: *Rhizocarpon dimelaenae* (*Knudsen 11484*, UCR). Bottom: *Rhizocarpon effiguratum* (*Knudsen 16619*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Onyx Summit, 34°12′07"N 116°45′07"W, 2439 m, 16.ix.2004, on granite, *K. Knudsen 1721* (UCR).

Rhizocarpon simillimum **(Anzi) Lettau SB**

FIG. 33A

NOTES. – *Rhizocarpon simillimum* was collected in Holcomb Valley on granite and is here reported new for California. It is rare in San Bernardino National Forest.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Holcomb Valley, 34°18′11"N 116°52′45"W, 2120 m, 18.xi.2014, on granite boulders, *K. Knudsen 17279 & J. Kocourková* (UCR).

Rhizoplaca chrysoleuca **(Sm.) Zopf SB, SJ**

NOTES. – *Rhizoplaca chrysoleuca* is common in San Bernardino National Forest and throughout the southern California mountains. For a photograph refer to Sharnoff (2014).

Selected specimen. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio Peak, 34°05′57"N 116°49′28"W, 3499 m, 19.vii.2015, on granite, *A.R. Pigniolo 799.1* (UCR).

Rhizoplaca glaucophana **(Nyl. *ex* Hasse) W.A.Weber SJ**

NOTES. – This small white species was collected on granite boulders along seasonal streams and is apparently rare in both the San Jacinto Mountains and in southern California.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, canyon along San Jacinto River, 33°43′12"N 116°47′21"W, 832 m, 17.xi.2003, on granite, *K. Knudsen 631* (UCR).

Rhizoplaca melanophthalma **(DC.) Leuckert & Poelt SB, SJ**

NOTES. – *Rhizoplaca melanophthalma* is common in San Bernardino National Forest and throughout the southern California mountains. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rattlesnake Canyon, 34°13′51"N 116°39′36"W, 1803 m, 10.xii.2014, on granite, *K. Knudsen 17233 & M. Crawford* (UCR).

Rhizoplaca subdiscrepans **(Nyl.) R.Sant. SR**

NOTES. – Unlike most members of the genus, *Rhizoplaca subdiscrepans* has a crustose thallus. It is rare in the study area, where it was found on Santa Rosa Mountain. More generally it is rare in southern California. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Rosa Mountain, 33°32'N, 116°18'W, 2048 m, 8.x.2008, on granite, *J.C. Lendemer 14998 & K. Knudsen* (UCR).

Rinodina bischoffi **(Hepp.) A.Massal. SB**

NOTES. – This saxicolous calciphile is frequent in the San Bernardino Mountains. For photographs refer to Sheard (2010) and Wirth et al. (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 34°18′16"N 116°47′00"W, 1895 m, on dolomite, 16.ix.2004, *K. Knudsen et al. 1689* (UCR).

Rinodina capensis **Hampe SB, SJ**

NOTES. – *Rinodina capensis* occurs on a wide range of trees and is common in the Sierra Nevada Mountains (Hutten et al. 2013). Sheard (2010) cited a collection from the San Jacinto Mountains made by T.H. Nash and annotated the specimen cited below collected by C.M. Wetmore (incorrectly listed as collected in 1905 in CNALH 2015). For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino National Forest [only location data], elevation lacking, on bark, 19.v.1966, *C.M. Wetmore 14689* (ASU; det. J.W. Sheard).

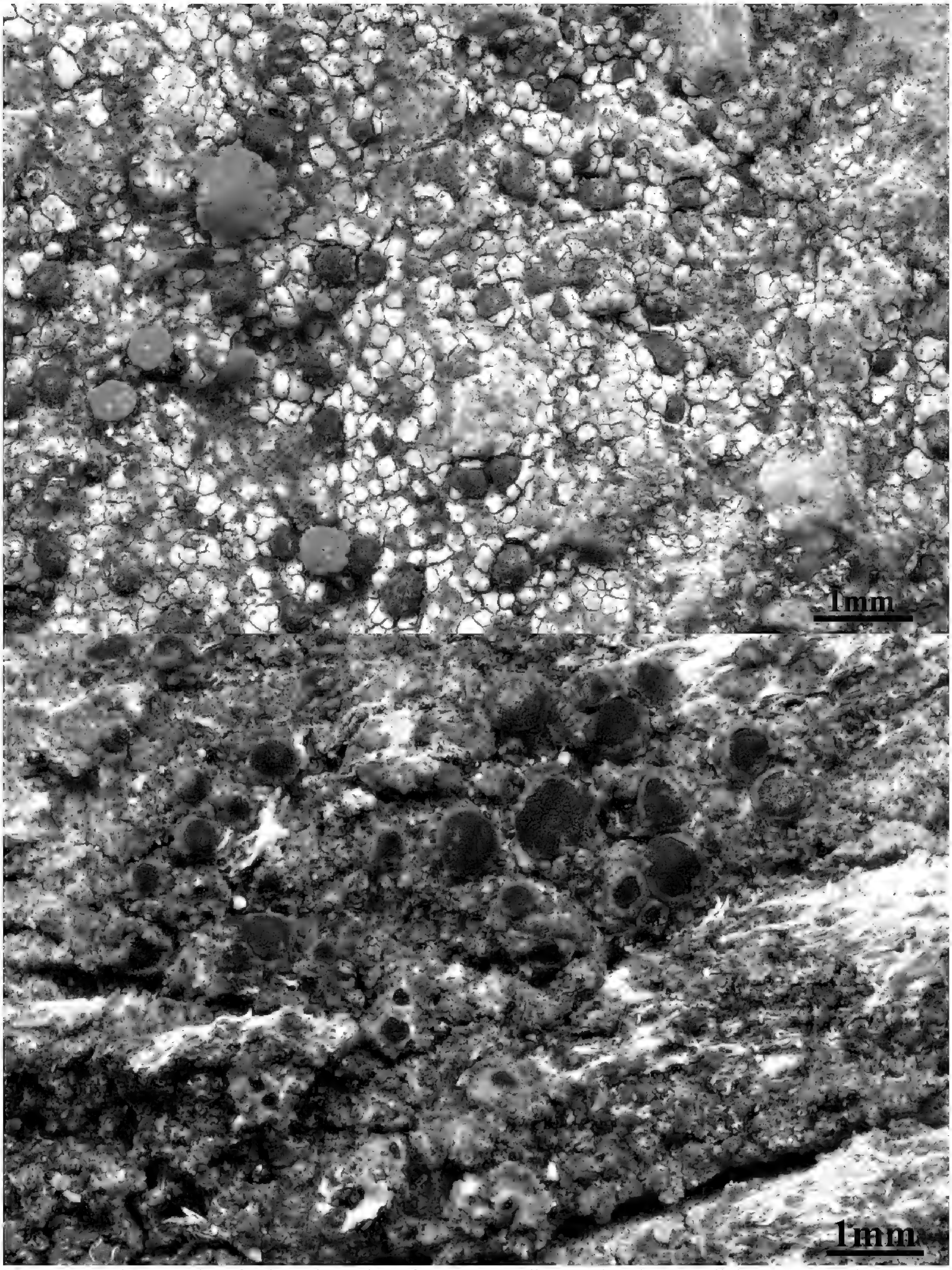

Figure 33. Photographs of selected species of San Bernardino National Forest lichens. Top: *Rhizocarpon simillimum* (*Knudsen 17279*, UCR). Bottom: *Rinodina lobulata* (*Knudsen 17293*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Rinodina endospora* Sheard SB**

NOTES. – *Rinodina endospora* is an infrequent member of corticolous communities in the San Bernardino Mountains. For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above 330, 34°12′25"N 117°08′57"W, 1580 m, 11.vi.2013, on *Quercus kelloggii*, *K. Knudsen 15842* (UCR).

***Rinodina exigua* (Ach.) Gray SB, SJ**

NOTES. – *Rinodina exigua* is an infrequent member of corticolous communities in the San Bernardino National Forest. For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′55"N 116°44′08"W, 1703 m, on *Abies concolor*, 20.iv.2004, *K. Knudsen 1029.1* (UCR; det. J.W. Sheard).

***Rinodina freyi* H.Magn. SB**

NOTES. – *Rinodina freyi* is the most common *Rinodina* on bark in the San Bernardino Mountains. There was originally some doubt about this identification because the ascospores of most specimens are smaller than is typical for this southern boreal species (Sheard 2010). However, a minority of specimens intergrade with the more typical size and provide the basis for the identification. These are the most southerly records for California and close to the southernmost for the continent. In the Sierra Nevada Mountains, it was reported to be common (Hutten et al. 2013). For a photograph and description refer to Sheard (2010).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, South Fork of Santa Ana River, 34°10′12"N 116°49′51"W, 1913 m, 11.vii.2015, on *Salix* bark, *K. Knudsen 17508* (SASK, UCR; det. J.W. Sheard).

***Rinodina intermedia* Bagl. SB**

NOTES. – *Rinodina intermedia* is common in biotic soil crusts in southern California. It was collected along the Santa Ana River at the very base of the San Bernardino Mountains. For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: base of San Bernardino Mountains, rocky alluvial bench along Santa Ana River, 34°05′31"N 117°06′45"W, 533 m, 1.v.2006, on coarse granite alluvium, *K. Knudsen 5934.1 & M. Knudsen* (UCR)

***Rinodina juniperina* Sheard SJ**

NOTES. – *Rinodina juniperina* was collected on an oak (*Quercus*) species by T.H. Nash in the San Jacinto Mountains (Sheard 2010). It is expected to occur in pinyon-juniper woodlands in the San Bernardino Mountains. It is frequent in the mountains of the Mojave Desert. For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, road from Banning to Idyllwild, 1980 m, 25.ii.1973, on *Quercus*, *T.H. Nash III 7075* (ASU; det. J.W. Sheard).

***Rinodina laevigata* (Ach.) Malme SB, SJ**

NOTES. – *Rinodina laevigata* is the most common *Rinodina* on conifers in San Bernardino Nationa Forest. For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Devil's Slide, 33°45′55"N 116°41′07"W, 1997 m, 15.ix.2006, on bark of *Pinus jeffreyi*, *K. Knudsen 7214* (UCR; det. J.W. Sheard).

***Rinodina lobulata* H.Mayrh. & Sheard SB**

FIG. 33B

NOTES. – *Rinodina lobulata* is here reported new for California from the San Bernardino Mountains. The nearest known populations are in northern Nevada (Sheard 2010). For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: Rattlesnake Canyon, 34°13′51"N 116°40′36"W, 1803 m, 10.xi.2014, on *Juniperus*, *K. Knudsen 17293 & M. Crawford* (UCR; det. J.W. Sheard).

Rinodina olivaceobrunnea **C.W.Dodge & Baker SB**

NOTES. – This species is common in soil crusts at northern latitudes, but rare in the San Bernardino Mountains, where it is known from only two collections. This is a southern range extension. For photographs and a description refer to McCune and Rosentreter (2007) and Sheard (2010) respectively.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Dollar Lake, 34°07′22"N 116°51′11"W, 2678 m, 6.vii.2012, in biotic soil crust, *J. Kocourková s.n. & K. Knudsen* (hb. K. &K.).

Rinodina oregana **H.Magn. SB**

NOTES. – *Rinodina oregana* is infrequent member of the corticolous communities in the San Bernardino Mountains. This is a southern range extension from the Sierra Nevada Mountains (Hutten et al. 2013, Sheard 2010). All specimens that we have examined were fertile. For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 33°44′10"N 116°42′07"W, 1875 m, 2.x.2008, on *Quercus*, *J.C. Lendemer 14670 & K. Knudsen* (NY).

Rinodina pyrina **(Ach.) Arnold SB**

NOTES. –This species is very common elsewhere in western North America but is rare in southern California**.** For a photograph and description refer to Sheard (2010).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: Mill Creek Canyon, alder woodland, 34°05′45"N, 117° 01′52"W, 952 m, 3.v.2014, on log, *K. Knudsen 16237 & A. Simmons* (SASK, UCR; det. by J.W. Sheard).

Rinodina santa-monicae **H.Magn. SB, SJ**

NOTES. – This species is frequent on oaks in southern California at low elevations. For a photograph and description refer to Sheard (2010).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Waterman Canyon, 34°12′44"N 117°17′19"W, 906 m, 23.xii.2013, on smooth bark of *Quercus chrysolepsis*, *K. Knudsen et al. 16373* (UCR).

Rinodina terrestris **Tomin. SB**

FIG. 34A

NOTES. – *Rinodina terrestris* is here reported new for California**.** The nearest known population is in northern Nevada in the Basin and Range Province (Sheard 2010). For photographs and a description refer to McCune and Rosentreter (2007) and Sheard (2010) respectively.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′22"N 116°47′44"W, 1858 m, 9.v.2005, mostly on turf of dead woody moss at base of *Juniperus*, *K. Knudsen 3992.1* (UCR; det. J.W. Sheard)

Rinodina zwackhiana **(Kremp.) Körber SB**

NOTES. – This calciphile is known in southern California from only a single collection made on dolomite on Bear Mountain. For a photograph and description refer to Sheard (2010).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Bear Mountain, 34°12′37"N 116°51′11"W, 2652 m, on dolomite, 25.viii.2004, *K. Knudsen 1607 & C.L. Wagner* (PH, UCR; det. J.W. Sheard).

Rufoplaca arenaria **(Pers.) Arup, Søchting & Frödén SB, SJ**

NOTES. – This species is better known by the name *Caloplaca arenaria* (Pers.) Müll. Arg, however we follow Arup et al. (2013) and treat it in the genus *Rufoplaca*. It is frequent in the San Bernardino National Forest.

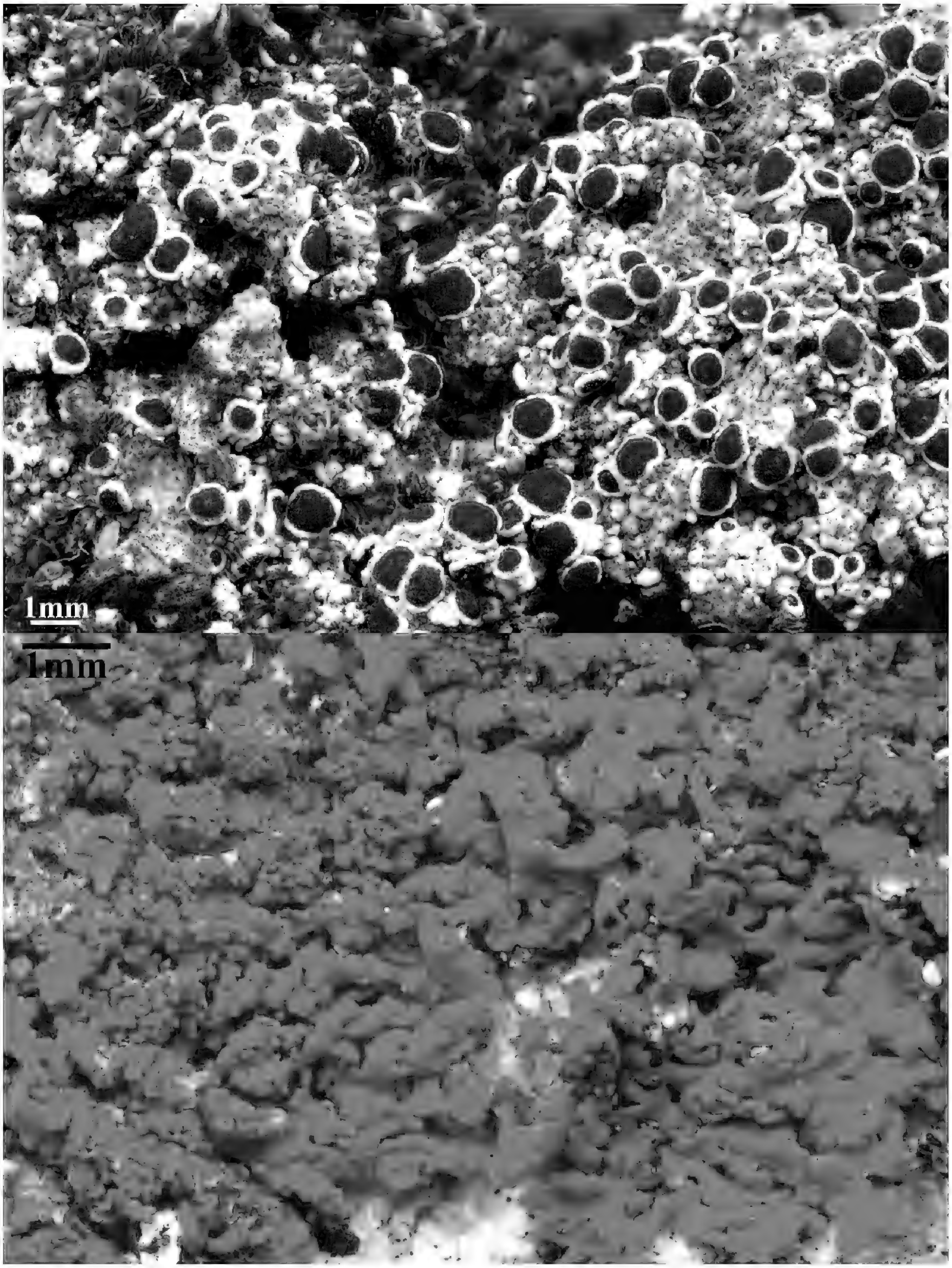

Figure 34. Photographs of selected species of San Bernardino National Forest lichens. Top: *Rinodina terrestris* (*Knudsen 3992*, UCR). Bottom: *Rusavskia sorediata* (*Pigniolo 861*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above Hwy. 18 between Snow Valley and Arctic Circle, 34°13′30"N 117°01′31"W, 2074 m, 11.vi.2013, on granite, *K. Knudsen 15850* (UCR).

***Rusavskia elegans* (Link) S.Y.Kondr. & Kärnefelt SB, SJ**

NOTES. – This species is common in the mountains of southern California. *Xanthoria elegans* (Link) Th.Fr. is the name that is currently most commonly used for this taxon, but we follow Arup et al. (2013) and treat it in the genus *Rusavskia*. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge to San Gorgonio Mountain along Vivian Creek, 34°05′11"N 116°50′20"W, 2597 m, 3.vi.2015, on rock, *A.R. Pigniolo 781* (UCR).

***Rusavskia sorediata* (Vain.) S.Y.Kondr. & Kärnefelt SJ**

FIG. 34B

NOTES. – This species is rare in the San Bernardino and San Jacinto Mountains. It was collected in the latter on Black Mountain by M.E. Hale in 1980 (CNALH 2015). It also occurs on the summit of San Gorgonio. For a photograph refer to Sharnoff (2014) under the name *Xanthoria sorediata* (Vain.) Poelt. Note that we follow Arup et al. (2013) and treat this taxon in the genus *Rusavskia* rather than *Xanthoria*.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Van Dusen Canyon, 34°17′15"N 116°52′48"W, 2198 m, 10.vii.2015, on granite, *K. Knudsen 17497* (UCR)

***Sarcogyne arenosa* (Herre) K.Knudsen & S.M.Standley SJ**

FIG. 35A

NOTES. – *Sarcogyne arenosa* is a common species in southern California, especially in the coastal ranges. It usually occurs on calcareous rock, but can occur on non-calcareous rock and in soil crusts. It occurs at lower elevations in the San Jacinto Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°43′27"N 116°49′53"W, 769 m, 7.iv.2006, on calcareous rock, *K. Knudsen 5717* (UCR).

***Sarcogyne clavus* (DC.) Kemp SB, SJ**

FIG. 35B

NOTES. – *Sarcogyne clavus* is infrequent in southern California and the San Bernardino National Forest.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Keller Cliffs area, 34°09′45"N 117°08′27"W, 1195 m, 2.i.2014, on granite, *K. Knudsen et al. 16407* (UCR).

***Sarcogyne crustacea* K.Knudsen & Kocourk. SJ**

NOTES. – *Sarcogyne crustacea* is a terricolous lichen originally described as *Biatorella terrena* Hasse from a small specimen made in the San Gabriel Mountains (FH!). It is a very rare species known only from two 21st century collections made in the Santa Ana and San Jacinto Mountains in biotic soil crusts. Further taxonomic study of the species is needed. For a description refer to Knudsen and Kocourková (2010c).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, western slope of San Jacinto Mountains above Hwy. 74, 33°42′49"N 116°46′36"W, 940 m, 11.xi.2003, on coarse granite-derived soil in *Selaginella* terraces on steep slope, *K. Knudsen 639* (ASU, UCR).

***Sarcogyne hypophaea* Nyl. SB, SJ**

FIG. 36A

NOTES. – *Sarcogyne hypophaea* is common in southern California from the islands to the desert. The name *Sarcogyne privigna* (Ach.) A.Massal. was previously misapplied to this taxon (Knudsen et al. 2013c). It occurs on non-calcareous rock and occasionally on calcareous rock, often on small pebbles. For a photograph refer to Sharnoff (2014).

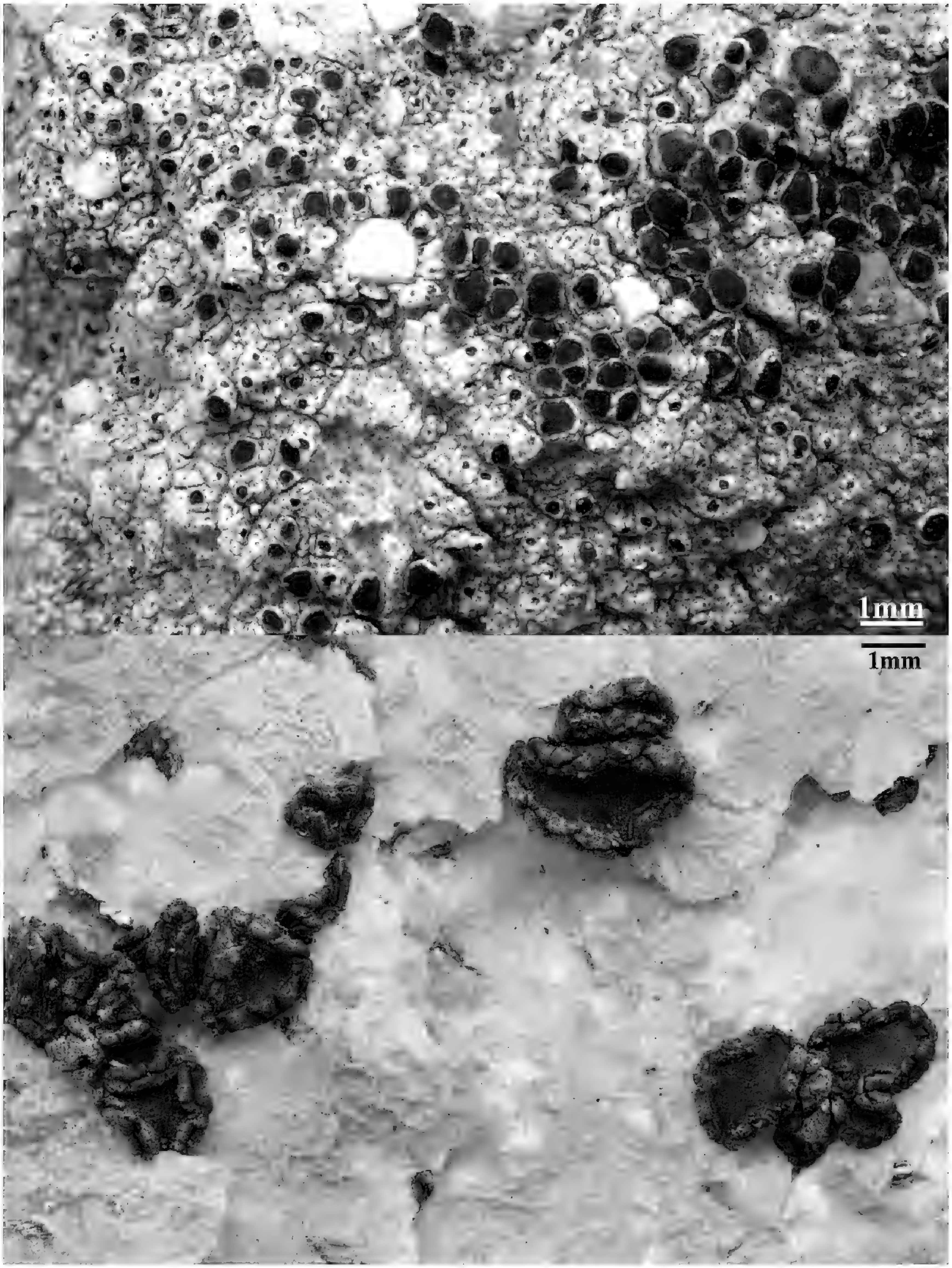

Figure 35. Photographs of selected species of San Bernardino National Forest lichens. Top: *Sarcogyne arenosa* (*Knudsen 5717*, UCR). Bottom: *Sarcogyne clavus* (*Knudsen 229010*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Bear Mountain, 34°12′37"N 116°51′11"W, 2652 m, 6.ii.2005, on dolomite rubble on ground, *K. Knudsen 1609 & C.L. Wagner* (PH, UCR).

***Sarcogyne mitziae* K.Knudsen & Kocourk. SB**

NOTES. – The recently described *Sarcogyne mitziae* is rare in southern California. A small population was discovered in the study area in the Pinnacles in a biological soil crust. This species appears to be on the verge of extirpation in southern California (Knudsen et al. 2013d). For a description and photograph refer to Knudsen et al. (2013d).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Pinnacles, 34°17′45"N 117°12′53"W, 1388 m, 13.xii.2013, on gravelly granite-derived soil, *K. Knudsen et al. 16361* (UCR).

***Sarcogyne novomexicana* H.Magn. SB**

FIG. 36B

NOTES. – *Sarcogyne novomexicana* occurs on dolomite and on decaying granite in drainages in the San Bernardino Mountains and in the Mojave Desert in the Little San Bernardino Mountains in Joshua Tree National Park.

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, steep W-facing slope above Wildhorse Meadows, 34°12′18"N, 116°47′21"W, 2587 m, 25.viii.2004, on decaying granite, K. *Knudsen 1601 & C.L. Wagner* (ASU, NY, MIN, UPS).

***Sarcogyne plicata* H.Magn. SB, SJ**

NOTES. – *Sarcogyne plicata* is common in granitic washes and alluvial plains in southern California at lower elevations and in the Mojave Desert in Joshua Tree National Park. It was described from Upland (FH!) and is rare in the San Bernardino National Forest. In the study area it is known from the base of the San Bernardino Mountains in the Santa Ana River floodplain and from the San Jacinto Mountains in a pebble plain in Garner Valley. For a description and photograph refer to Knudsen and Kocourková (2011).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Forbes Ranch Rd., 33°40′25"N 116°36′45"W, 1651 m, 26.iii.2006, on granite in pebble plain, *K. Knudsen 5698* (UCR).

***Sarcogyne regularis* Körber SJ, SB**

NOTES. – This cosmopolitan heavily pruinose morphotype of this calciphile is infrequent in southern California. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′14"N 116°47′10"W, 1841 m, 9.vi.2005, on dolomite in shade of juniper, *K. Knudsen 3377* (UCR).

***Sarcogyne similis* H.Magn. SB, SJ**

NOTES. – *Sarcogyne similis* is a common species in California but infrequent in the San Bernardino National Forest. It is probably the most common *Sarcogyne* in North America.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Union Flats, 34°19′13"N 116°52′07"W, 2349 m, 7.x.2004, on granite rocks, *K. Knudsen 1831 & C.L. Wagner* (UCR).

***Sarcogyne squamosa* K.Knudsen & McCune SB**

NOTES. – *Sarcogyne squamosa* was recently described from Oregon. It is here reported new for California from two collections made in the San Bernardino Mountains where it appears to be rare. For a description and photograph refer to Knudsen and McCune (2013).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 2N93 near Hwy. 38, 34°10′29"N 116°45′11"W, 2138 m, 23.xi.2014, on granite, *K. Knudsen 17181* (UCR).

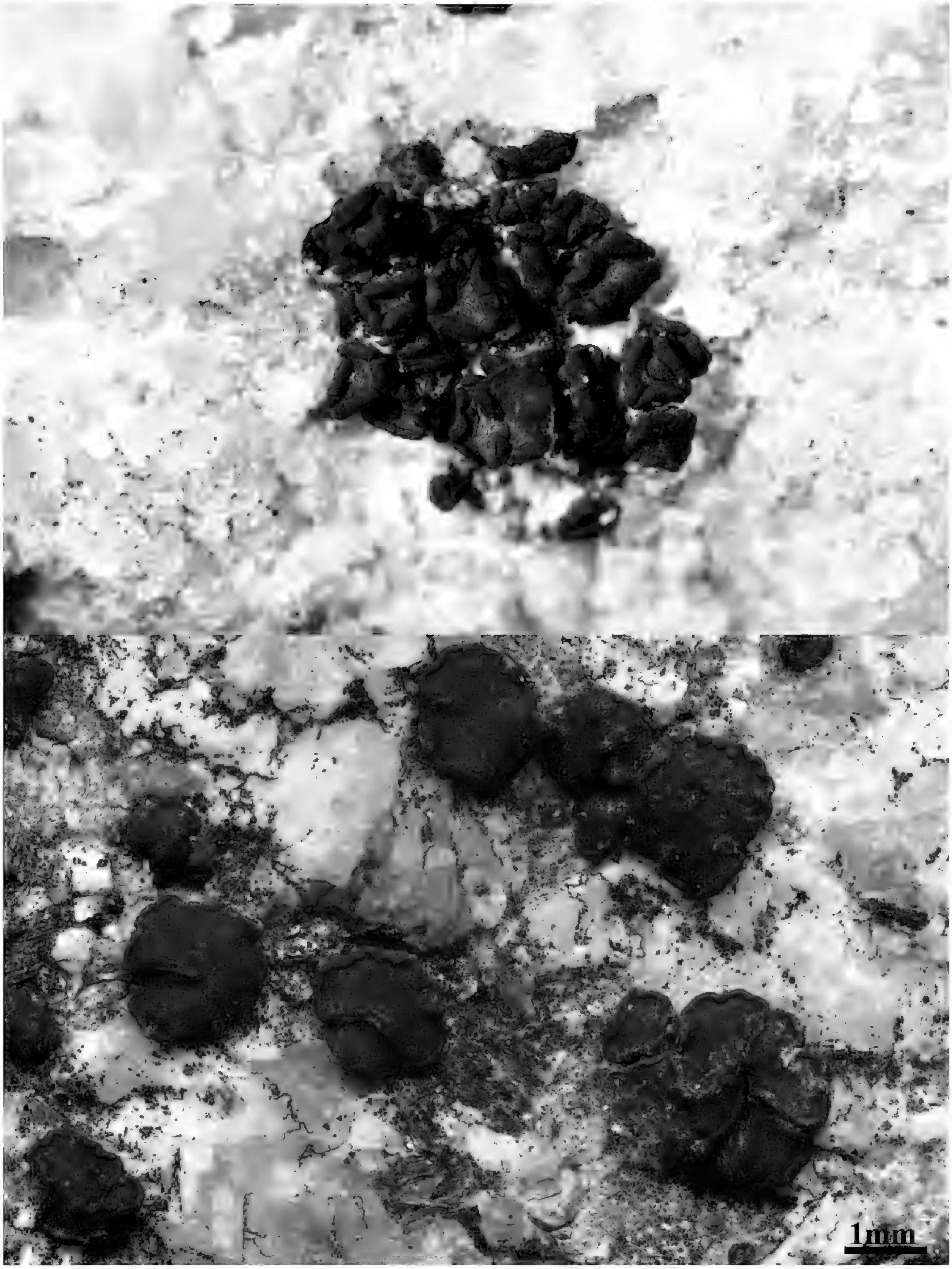

Figure 36. Photographs of selected species of San Bernardino National Forest lichens. Top: *Sarcogyne hypophaea* (*Schultz 16619C*, HBG; photograph by Matthias Schultz, copyright M. Schultz). Bottom: *Sarcogyne novomexicana* (*Knudsen 15859*, UCR; photograph by Tom Wheeler, copyright U.S. National Forest Service).

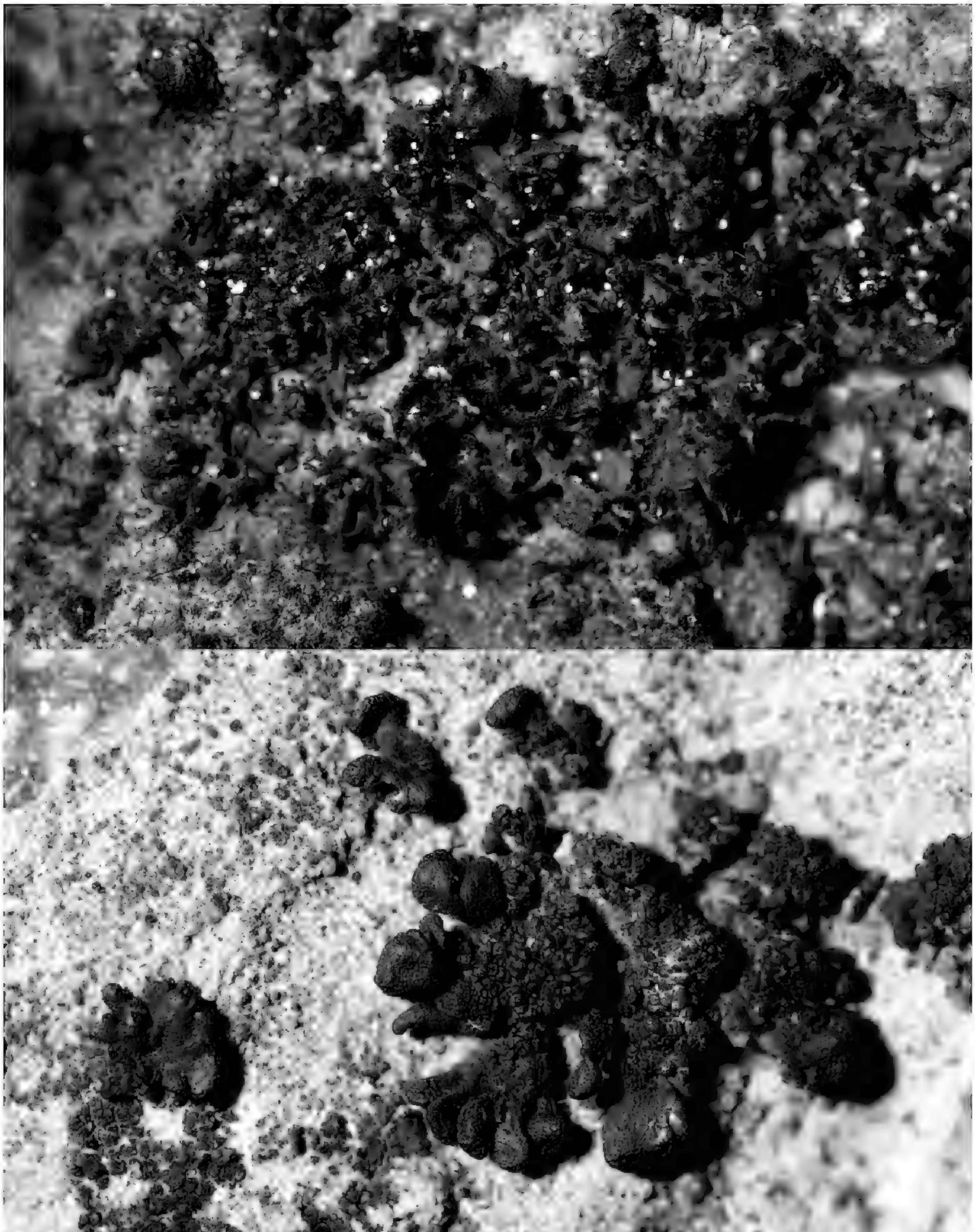

Figure 37. Photographs of selected species of San Bernardino National Forest lichens. Top: *Scytinium cellulosum* (*Schultz 16624*, HBG). Bottom: *Scytinium plicatile* (*Schultz 16555A*, HBG). Photographs by Matthias Schultz (copyright, M. Schultz).

Scytinium californicum **(Tuck.) Otálora, P.M.Jørg. & Wedin SB, SJ**

NOTES. – *Scytinium californicum* is frequent in San Jacinto Mountains but rare in the drier San Bernardino Mountains. Many previous records would be found under the name *Leprogium californicum* Tuck., but here we follow Otálora et al. (2014) and treat the species in *Scytinium*. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, slope above dry creek, 34°09′14"N, 116°56′40"W, 1229 m, 23.i.2004, on mosses over granite, *K. Knudsen 762 et al.* (UCR).

Scytinium cellulosum **(P.M.Jørg. & Tønsberg) Otálora, P. M. Jørg. & Wedin SJ**

FIG. 37A

NOTES. – This small cyanolichen was formerly placed in the genus *Leptogium*, but we follow Otálora et al. (2014) and treat it in *Scytinium*. Here it is reported from granite boulders in a cool, shaded situation in the gorge of the North Fork of San Jacinto River. *Scytinium cellulosum* is a quite characteristic epiphyte with widespread occurrences from central California to Alaska. Given the striking similarity with authentic epiphytic material collected and studied by us (MS) and the mesic climate in the river gorge, we regard this occurrence on acidic rock to be unusual but still covered by the general ecological preferences of the species. It is common in Yosemite (Hutten et al. 2013) and this is a southern range extension.

Specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork San Jacinto River, river bed with large, shaded boulders, 33°47'54"N 116°44'10"W, 1685 m, 28.ix.2009, on (seasonally splashed) granite rock, *M. Schultz 16624* & *K. Knudsen* (HBG).

Scytinium lichenoides **(L.) Otálora, P.M.Jørg. & Wedin SJ**

NOTES. – This cyanolichen is less frequent than *S. californicum* in the San Jacinto Mountains. It was formerly placed in the genus *Leptogium*, but we follow Otálora et al. (2014) and treat it in *Scytinium*. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Apple Cayon, near beginning of Split Trial, along seasonal streambed, 33°41'57"N 116°39'09"W, 1484 m, on moss, 24. Ii.2010, *K. Knudsen 11633.2 et al*. (UCR).

Scytinium palmatum **(Huds.) Gray SJ**

NOTES. – This cyanolichen is infrequent in southern California and in the study area is known from a single collection made in the San Jacinto Mountains. The species was formerly placed in the genus *Leptogium*, but we follow Otálora et al. (2014) and treat it in *Scytinium*. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Halfway Spring, 33°44′31"N, 116°47′11"W, 1157 m, 11.i.2008, on soil, *J.C. Lendemer 11493 & K. Knudsen* (NY).

Scytinium plicatile **(Ach.) Otálora, P.M.Jørg. & Wedin SB**

FIG. 37B

NOTES. – This is a widespread cyanolichen which occurs in a variety of habitats. The material cited below was collected on exposed marble boulders at Cactus Flat where it was accompanied by *Blennothallia crispa* (syn. *Collema crispum*). The species was formerly placed in the genus *Leptogium*, but we follow Otálora et al. (2014) and treat it in *Scytinium*.

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flat SE of junction of Rd. 18 and Smarts Ranch Rd. (FR 3N03), rocky slope, 34°18'16"N 116°47'55"W, 27.ix.2009, 1860 m, on NW-exposed marble boulders, *M. Schultz 16619e* (HBG).

Scytinium **sp. SJ**

FIG. 38A

NOTES. – This lichen has been collected on at least seasonally flushed or sprayed granite boulders in shaded situations in the gorge of the North Fork of the San Jacinto River. The thallus develops from firmly attached, thin roundish squamules which become marginally incised giving rise to flat, lingulate lobules with smooth surface and rounded, somewhat uplifted tips. The lobes tend to be orientated

into one direction (induced by running water?) and may become somewhat imbricate. The thallus anatomy is paraplectenchymatous throughout composed of small, ± isodiametric cells. The material is abundantly fertile with laminal, substipitate apothecia. The species certainly belongs to *Scytinium* but does not fit any of the species treated in the Sonoran Desert Lichen Flora (Jørgensen & Nash 2004). It has some affinities with *S. rivale* (Tuck.) Otálora, P. M. Jørg. & Wedin, which is known from flushed stones in cold mountain creeks and is widespread in the Cascades and Sierra Nevada Mountains. However, the San Jacinto sample is reddish brown (to grayish in shade) and lacks the emerald color which is often seen in *S. rivale*. It further lacks the pronounced placodioid growth and forms smaller lobules. Finally, initial molecular data obtained by one of us (MS) suggest that the San Jacinto species is phylogenetically different from typical *S. rivale*. Further studies are needed to verify the status of this interesting lichen.

Specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork San Jacinto River, river bed with large, shaded boulders, 33°47'54"N 116°44'10"W, 1685 m, 28.ix.2009, on seasonally flushed or splashed granite rock, *M. Schultz 16623* & *K. Knudsen* (HBG).

***Scytinium subaridum* (P.M.Jørg. & Goward) Otálora, P.M.Jørg. & Wedin SJ**

FIG. 38B

NOTES. – This cyanolichen is only known from southern California from a single collection made in the San Jacinto Mountains. It also occurs further north in Yosemite National Park (Hutten et al. 2013). The species was formerly placed in the genus *Leptogium*, but we follow Otálora et al. (2014) and treat it in *Scytinium*.

Specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, road from Banning to Idyllwild, 1980 m, 25.ii.1974, on rock among mosses, *T.H. Nash III 7065* (ASU, WIS; det. by P.M. Jørgensen).

***Solorina spongiosa* (Ach.) Anzi SB**

NOTES. – This cyanolichen is likely a rare Pleistocene relic in San Bernardino Mountains. It is known from a single population in southern California (Knudsen & Crawford 2014). For photographs refer to Brodo et al. (2001) and Hinds and Hinds (2007).

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio Wilderness, [location redacted], 2598 m, on rock, 25.vii.2014, *M. Crawford 1* (UCR).

***Sporastatia testudinea* (Ach.) A.Massal. SJ, SR**

NOTES. – This species is common in the Sierra Nevada Mountains. In southern California it is rare in the San Jacinto, San Gabriel and Santa Rosa Mountains. For a photograph refer to Brodo et al. (2001).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Tahquitz Peak, 33°45′10"N 116°40′42"W, 2488 m, 4.x.2004, on hard granite, *K. Knudsen 1790* (PH, UCR).

***Squamulea squamosa* (B.de Lesd.) Arup, Søchting & Frödén SJ**

NOTES. – This species is common in the Sonoran and Mojave Deserts in southern California and also occurs in the San Jacinto Mountains. For a photograph refer to Knudsen et al. (2013a) under the name *Caloplaca squamosa* (B. de Lesd.) Zahlbr. While most records will be found under the name *C. squamosa*, we follow Arup et al. (2013) and treat the species in *Squamulea*.

Selected specimen. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, slopes above Dry Creek, 33°42′14"N 116°44′34"W, 1282 m, 23.i.2004, on granite, *K. Knudsen 786.1 & K. Kramer* (UCR)

***Squamulea subsoluta* (Nyl.) Arup, Søchting& Frödén SJ**

NOTES. – This species is common in southern California but rare in San Bernardino National Forest. For a photograph refer to Sharnoff (2014) under the name *Caloplaca subsoluta* (Nyl.) Zahlbr. While most records will be found under the name *C. subsoluta*, we follow Arup et al. (2013) and treat the species in *Squamulea*.

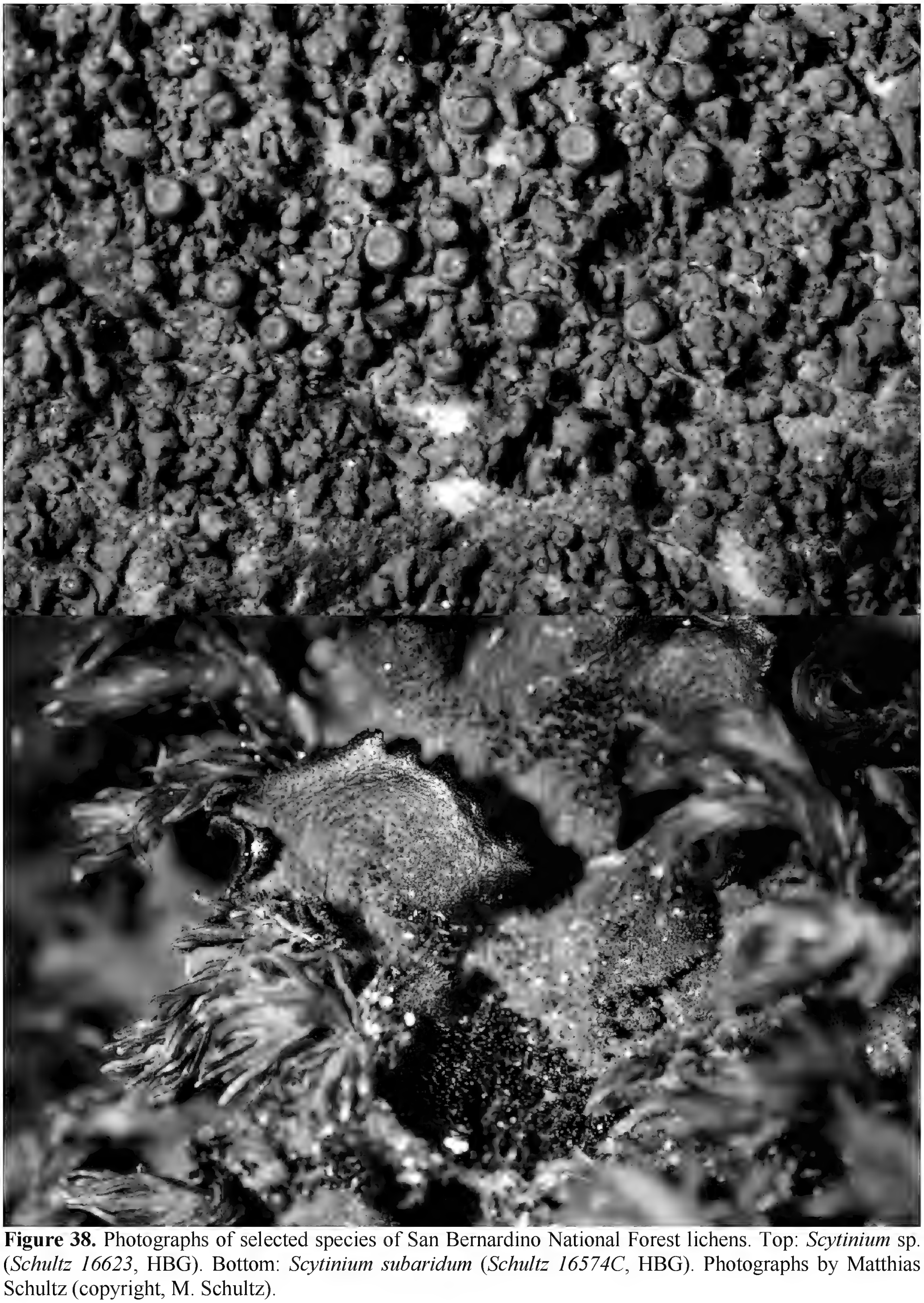

Figure 38. Photographs of selected species of San Bernardino National Forest lichens. Top: *Scytinium* sp. (*Schultz 16623*, HBG). Bottom: *Scytinium subaridum* (*Schultz 16574C*, HBG). Photographs by Matthias Schultz (copyright, M. Schultz).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains. Middle Rouse Ridge, 33°41′25"N 116°47′41"W, 989 m, 5.x.2008, on rock, *J.C. Lendemer 14760 & K. Knudsen* (NY).

Staurothele areolata **(Ach.) Lettau SB, SJ**

NOTES. – This species is common in the San Bernardino National Forest where it occurs on calcareous and non-calcareous rock, especially where seasonally inundated. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Rattlesnake Canyon, 34°13′51"N 116°39′36"W 1803 m, 10.xii.2014, on granite along seasonal creek, *K. Knudsen 17227 & M. Crawford* (UCR).

Staurothele drummondii **(Tuck.) Tuck. SB, SJ**

NOTES. – This species is common in the San Bernardino National Forest where it occurs on calcareous and non-calcareous rock, especially where seasonally inundated. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Snow Valley, 34°13′10"N 117°07′20"W, 1985 m, 1.xi.2013, on hard granite at base of outcrop, seasonally flushed with water, *K. Knudsen 16267 & J. Kocourková* (UCR).

Staurothele fissa **(Taylor) Zwackh SB, SJ**

NOTES. – *Staurothele fissa* is apparently rare in seasonal streambeds in the San Bernardino National Forest. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, near Miller Canyon, 34°16′11"N 117°17′26"W. 1146 m, 15.xi.2014, on hard granite in seasonal stream, *K. Knudsen 17058 & J. Kocourková* (UCR).

Staurothele monicae **(Zahlbr.) Wetmore SB. SJ**

NOTES. – This species is common in the mountains of the Mojave Desert. It is common at Cactus Flats in the San Bernardino Mountains. For photographs refer to Knudsen et al. (2013a) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′18"N 116°37′26"W, 1830 m, 7.vi.2005, on dolomite, *K. Knudsen 3331A* (UCR).

Strangospora deplanata **(Almq.) Clauz. & Cl.Roux SJ**

NOTES. – *Strangospora deplanata* is rare in the San Jacinto Mountains and more generally in southern California. It grows on dry decorticated wood.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Hall Canyon, UC James Reserve, lower Four Sisters trail, 33°48′26"N 116°46′30″W, 1646 m, 8.xi.2014, on dry conifer wood, *K. Knudsen 16309* (UCR).

Strangospora microhaema **(Norman) R.A.Anderson SJ**

NOTES. – This conspicuous species is only known from southern California from a single collection made in the San Jacinto Mountains. It appears to become more frequent in the Sierra Nevada Mountains (Hutten et al. 2013).

Specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Herkey Canyon, 33°42′46"N 116°40′56"W, 1520 m, 25.iv.2004, on *Sambucus*, *Knudsen et al. 1034* (ASU, PH, UCR)

Strangospora moriformis **(Ach.) Stein SJ**

NOTES. – This is most common species in the genus in southern California, occurring also on the wood of chaparral at low elevations. For a photograph refer to Nash et al. (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Lily Rock, 33°45′37"N 116°41′09"W, 2193 m, 21.vii.2004, on dry conifer wood, *K. Knudsen 1500 & K. Kramer* (UCR).

***Thelomma ocellatum* (Körber) Tibell SJ**

NOTES. – This species is rare and usually sterile in southern California, and only becomes more frequent in northern California. It often grows on fenceposts. The species is currently considered rare in the San Jacinto Mountains where it was collected by the eminent Swedish lichenologist L. Tibell. For photographs of the species and extensive discussion of the North American populations refer to Lendemer (2013c).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, 3 km SE of jct of Hwy. 74 and 243, 1370 m, 5.ix.1977, on fenceposts, *L. Tibell L.7769 = Caliciales Exsiccatae 25* (ASU).

***Toninia ruginosa* subsp. *ruginosa* (Tuck.) Herre SJ**

NOTES. – This species is common in many areas of its range but is infrequent in the San Jacinto Mountains. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Lily Rock, 33°45′37"N 116°41′06"W, 2243 m, 21.vii.2004, in decomposing granite crevices, *K. Knudsen 1486 & K. Kramer* (UCR).

***Toninia sedifolia* (Scop.) Timdal SB, SJ**

NOTES. – This calciphile is common on calcareous rock in the San Bernardino National Forest. For a photograph refer to see Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, East Canyon, 33°39′23"N 116°35′07"W, 1789 m, 1.xii.2003, on limestone, *K. Knudsen 696* (UCR).

***Toninia submexicana* B.de Lesd. SB, SJ**

NOTES. – This species is rare in the San Jacinto Mountains. H.E. Hasse collected it at Arrowhead Hot Springs at the base of the San Bernardino Mountains (FH!). For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, along State Hwy. 74 S of Palm Desert, near base of Seven Level Hill, 530 m, 21.iii.1998, on soil, *E. Timdal s.n.* (O).

***Trapelia coarctata* (Turner) M.Choisy SB**

NOTES. – This species is less common than *Trapelia glebulosa* and usually occurs in biotic soil crusts or on decaying granite in coastal southern California. It is known from a single collection in the San Bernardino Mountains.

Selected specimen examined. **– U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, the Pinnacles, 34°17′45"N 117°12′53"W, 1388 m, 13.xii.2013, in biotic soil crust with mosses and other lichens, *K. Knudsen et al. 16357* (UCR).

***Trapelia glebulosa* (Sw.) J.R.Laundon SB**

NOTES. – Though very common in the Santa Ana Mountains and other coastal areas, it is apparently rare in San Bernardino National Forest and known from only two collections. This species usually occurs on rock and consolidated soil as a pioneer. For a photograph refer to Sharnoff (2014).

Selected specimen examined. **– U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Keller Cliffs, 34°09′45"N 117°08′27"W, 1195 m, 3.i.2014, on decaying granite, *K. Knudsen et al. 16428* (UCR).

***Trapeliopsis flexuosa* (Fr.) Coppins & P.James SB, SJ**

NOTES. – This species is common throughout southern California except in the desert mountains. It grows on conifer and oak wood and is regularly found on untreated wood fences and discarded scrap lumber. Collected on a burnt fencepost in Laguna Beach (UCR). For a photograph refer to Sharnoff (20014.

Selected specimen examined. **– U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, seasonal creek at Hwy. 138, 34°15′51"N 117°17′27"W, 1285 m, 14.viii.2015, on wood, *K. Knudsen 17700* (UCR).

***Trapeliopsis glaucopholis* (Nyl. *ex* Hasse) Printzen & McCune SB, SR**

NOTES. – This is a common species in biotic soil crusts in cismontane southern California. It is rare in the San Jacinto Mountains and only known from the San Bernardino Mountains on the basis of a historical collection made by H.E. Hasse in 1897 (ASU). For a photograph refer to McCune and Rosentreter (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Toll Rd., 33°44′11"N 116°47′38"W, 1036 m, 23.i.2004, on soil, *K. Knudsen et al. 791* (UCR).

***Trapeliopsis granulosa* (Hoffm.) Lumbsch SB, SJ**

NOTES. – This species is infrequent in southern California and is usually found on wood. In the Sierra Nevada Mountains it becomes common and often occurs on soil, organic matter, and the bases of conifer trees (Hutten et al. 2013). For a photograph refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, South Ridge, 33°44′14"N 116°41′48"W, 2027 m, 4.x.2004, on partially burnt conifer wood, *K. Knudsen 1801.1* (NY, UCR).

***Trapeliopsis steppica* McCune & Camacho SB, SJ**

FIG. 39A

NOTES. – This species is rare in southern California and all known populations are small. The species is identified easily by the green soralia, but as you can in the photograph published here the color of soralia can be pale when most of the fresh soredia have been dispersed. For a photograph refer to McCune and Rosentreter (2007).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Waterman Canyon, 34°12′26"N 117°17′09"W, 881 m, 23.xii.2013, on granite, *K. Knudsen et al. 16370* (UCR).

***Trimmatothelopsis terricola* (H.Magn.) K.Knudsen & Lendemer SJ**

NOTES. – *Trimmatothelopsis terricola* is an obligate terricolous lichen in soil crusts in cismontane southern California and on Santa Cruz Island. It was originally described as *Acarospora terricola* H.Magn. from an H.E. Hasse collection from the Santa Monica Mountains (Magnusson 1929). It usually forms bullate areoles but some inland populations become lobate and could be mistaken for a *Psora*. It occurs in biotic soil crusts on *Selaginella* terraces on the western slopes of the San Jacinto Mountains. For the unusual position of this taxon in Acarosporaceae see Westberg et al (2015a). For a description and photograph refer to Knudsen and Lendemer (2016). For more photographs refer to Nash et al. (2007) and McCune and Rosentreter (2007).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Santa Jacinto Mountains, 33°42′46″N 116°46′36″W, 891 m, 20.iv.2004, on steep western slopes on granite-derived soil in biotic soil crust, *K. Knudsen 1033* (ASU, UCR).

***Umbilicaria americana* Poelt & T.H.Nash SB**

NOTES. – This macrolichen is rare in the San Bernardino Mountains. This is a southern range extension from Sierra Nevada Mountains where it is apparently also rare (Hutten et al. 2013). For a description and photograph refer to Brodo et al. (2001).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, FS 2N93 off CA 38, 34°08′53"N 116°46′19"W, 2167 m, 7.x.2008, on granite, *J.C. Lendemer 14911 & K. Knudsen* (NY).

***Umbilicaria hyperborea* (Ach.) Hoffm. SB, SJ**

NOTES. – *Umbilicaria hyperborea* occurs at high elevations in the San Bernardino National Forest. It occurs on San Jacinto Peak (*Pigniolo 950*, SBBG) and on San Gorgonio Peak (see below). For photographs refer to Brodo et al. (2001), McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, San Gorgonio Peak, 34°05′57"N 116°49′28"W, 3499 m, 19.vii.2015, on granite, *A.R. Pigniolo 787.2* (UCR).

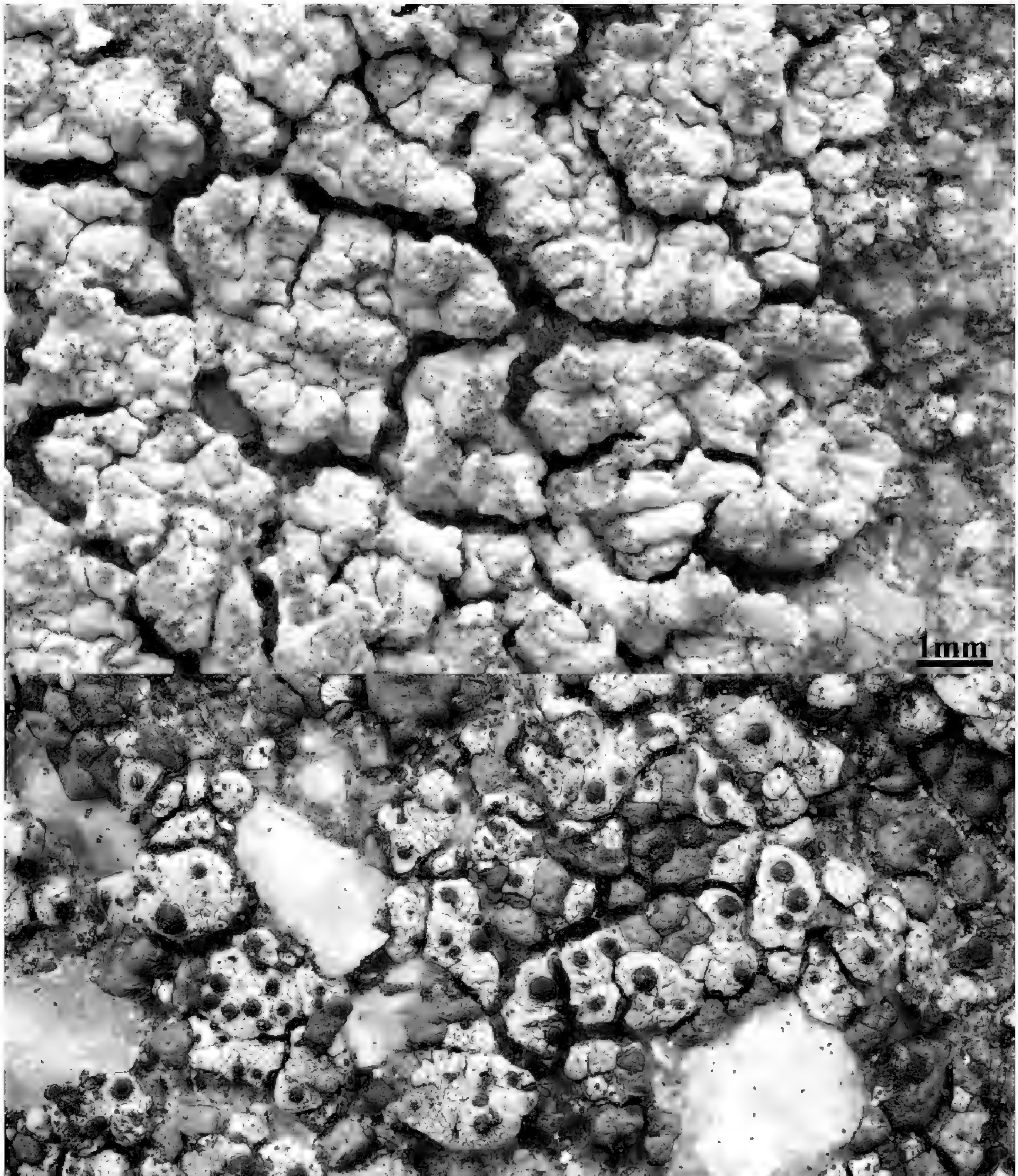

Figure 39. Photographs of selected species of San Bernardino National Forest lichens. Top: *Trapeliopsis steppica* (*Knudsen 9277*, UCR). Bottom: *Verrucaria bernardinensis* (*Knudsen 2630*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Umbilicaria phaea* Tuck. SB, SJ**

NOTES. – This is the most common *Umbilicaria* in California and it occurs at a wide range of elevations. For photographs refer to Knudsen et al. (2013a) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, San Jacinto State Park Wilderness, trail to Round Valley, 33°48′45"N 116°38′36"W, 2565 m, 28.v.2013, on granite, *K. Knudsen 15613* (UCR).

***Umbilicaria polaris* (Schol.) Zahlbr. SB, SJ**

NOTES. – *Umbilicaria polaris* is common at high elevations in the San Bernardino National Forest, including on San Jacinto Peak and San Gorgonio. The name *Umbilicaria krascheninnikovii* (Savicz) Zahlbr. was misapplied to this taxon (Davydov et al. 2010). Refer to McCune and Geiser (2009) and Sharnoff (2014) for photographs under the name *U. krascheninnikovii*.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, High Creek Falls, 34°05′05"N 116°50′53"W, 1575 m, 18.vii.2015, on granite, *A. R. Pigniolo 755* (UCR).

***Umbilicaria virginis* Schaer. SB, SJ**

NOTES. – *Umbilicaria virginis* is a rare high elevation species in the San Bernardino National Forest and southern California. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, ridge to San Gorgonio Mountain along Vivian Creek, 34°05′11"N 116°50′20"W, 3057 m, 19.vii.2015, on granite, *A.R. Pigniolo 788.1* (UCR).

***Usnea hirta* (L.) Weber ex F.H.Wigg. SB, SJ**

NOTES. – *Usnea hirta* is locally abundant on upper Rouse Ridge in the San Jacinto Mountains. It was collected in Cajon Pass in San Bernardino National Forest by G.L. Moxley in 1922 where it has probably been extirpated by fires**.** This is the most common *Usnea* in cismontane southern California. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Rouse Ridge, 33°41′25"N 116°47′41"W, 1171 m, 5.ii.2004, on *Adenostoma fasciculatum, K. Knudsen et al. 852* (UCR).

***Usnea lapponica* Vain. SJ**

NOTES. – *Usnea lapponica* is rare in the San Jacinto Mountains and may have been extirpated in the fire of 2014. For photographs refer to see McCune and Geiser (2009) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Cedar Springs, W side of Palm View Mountain, 33°40′37"N 116°34″39"W, 1967 m, 13.viii.2005, on *Abies concolor*, *K. Knudsen 3472* (UCR).

***Verrucaria aethiobola* Wahlenb. SB**

NOTES. – This *Verrucaria* is rare in the San Bernardino Mountains where it usually occurs in perennial streams on granite. For photographs refer to Thüs and Schultz (2009) and Wirth et al. (2013)

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, unnamed small canyon off Hwy. 18, 34°13′36"N 117°17′41"W, 1083 m, 14.iii.2014, on granite in stream, *K. Knudsen et al. 16380* (UCR).

***Verrucaria bernardinensis* Breuss SB**

FIG. 39B

NOTES. – This parasitic species on members of the genus *Staurothele* is common in the mountains of the Mojave Desert on non-calcareous and calcareous rock (Knudsen & Werth 2008, Knudsen et al. 2013a). It was described from Cactus Flats in the San Bernardino Mountains and the type collection made in the San Bernardino Mountains is cited below. For a photograph refer to Knudsen et al. (2013a).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′18"N 116°37′26"W, 1830 m, 7.vi.2004, on limestone and *Staurothele drummondii*, *K. Knudsen 3301B* (LI, UCR).

***Verrucaria furfuracea* (B.de Lesd) Breuss SB**

FIG. 40A

NOTES. – This is a common calciphile found throughout southern California, sometimes on cement. It is rarely fertile, and often overlooked because of the inconspicuous appearance of the brown areoles with marginal soredia. For a photograph of fertile specimen refer to Knudsen and Kocourková (2012).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Smarts Ranch Rd., 34°15′39"N 116°43′36"W, 1961 m, 5.xi.2014, on limestone in seasonal streambed, *K. Knudsen et al. 17029.1* (UCR).

***Verrucaria fusca* Pers. *ex* Ach. SJ**

NOTES. – This species is common in California in drainages, seeps and seasonal stream beds, but it is rare in San Jacinto Mountains. For photograph refer to Knudsen and Kocourková (2012).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Devil's Slide, 33°46′35"N 116°40′42"W, 2317 m, 15.ix.2006, on hard granite, *K. Knudsen 7176* (UCR).

***Verrucaria margacea* (Wahlenb.) Wahlenb. SJ**

FIG. 40B

NOTES. – This aquatic species is rare in southern California and is only known from a single collection made in Mount San Jacinto State Park. It is common in Yosemite (Hutten et al. 2013)

Specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Mount San Jacinto State Park Wilderness, trail to Round Valley, 33°48′40"N 116°38′53"W, 2589 m, 3.vi.2013, on granite in seasonal stream, *K. Knudsen 15613* (LI, UCR; det. O. Breuss).

***Verrucaria mimicrans* Servít SB**

NOTES. – This species is rare in the San Bernardino Mountains. It is frequent on the Channel Islands on calcareous substrates.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Mill Creek Canyon, 34°06′00"N 117°01′24.3"W, 3280 m, 5.iii.2014, along creek on metamorphosed shale bench, *K. Knudsen 16442 & A. Simmons* (UCR).

***Verrucaria muralis* Ach. SJ**

NOTES. – The common calciphile *Verrucaria muralis* is only known in the San Bernardino National Forest from Rouse Ridge in the San Jacinto Mountains. For photographs refer to Krzewicka (2012) and Knudsen and Kocourková (2012).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, middle Rouse Ridge, 33°42′42"N 116°43′06"W, 989 m, 5.x.2008, on calcareous rock, *J.C. Lendemer 14763 & K. Knudsen* (NY).

***Verrucaria othmarii* K.Knudsen & L.Arcadia SB**

FIG. 41A

NOTES. – This species occurs on calcareous rock, sandstone and soft granite and is frequent in the San Bernardino Mountains. In Breuss (2007) it is described under the name *Verrucaria rupicola* B. des Lesd., an invalid homonym of *V. rupicola* (L.) Humb.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Smarts Ranch Rd., 34°15′39"N 116°43′36"W, 1961 m, 5.xi.2014, along seasonal stream bed on limestone, *K. Knudsen et al. 17021* (UCR).

***Verrucaria sphaerospora* Anzi SB, SJ**

NOTES. – This species appears to be frequent in southern California but can easily be overlooked as it is usually collected in mixed saxicolous communities. For photograph refer to Krzewicka (2012).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Forbes Ranch Rd., 33°40′25"N 116°36′45"W, 1651 m, 26.iii.2006, on granite. *K. Knudsen 5697* (UCR; det. O. Breuss).

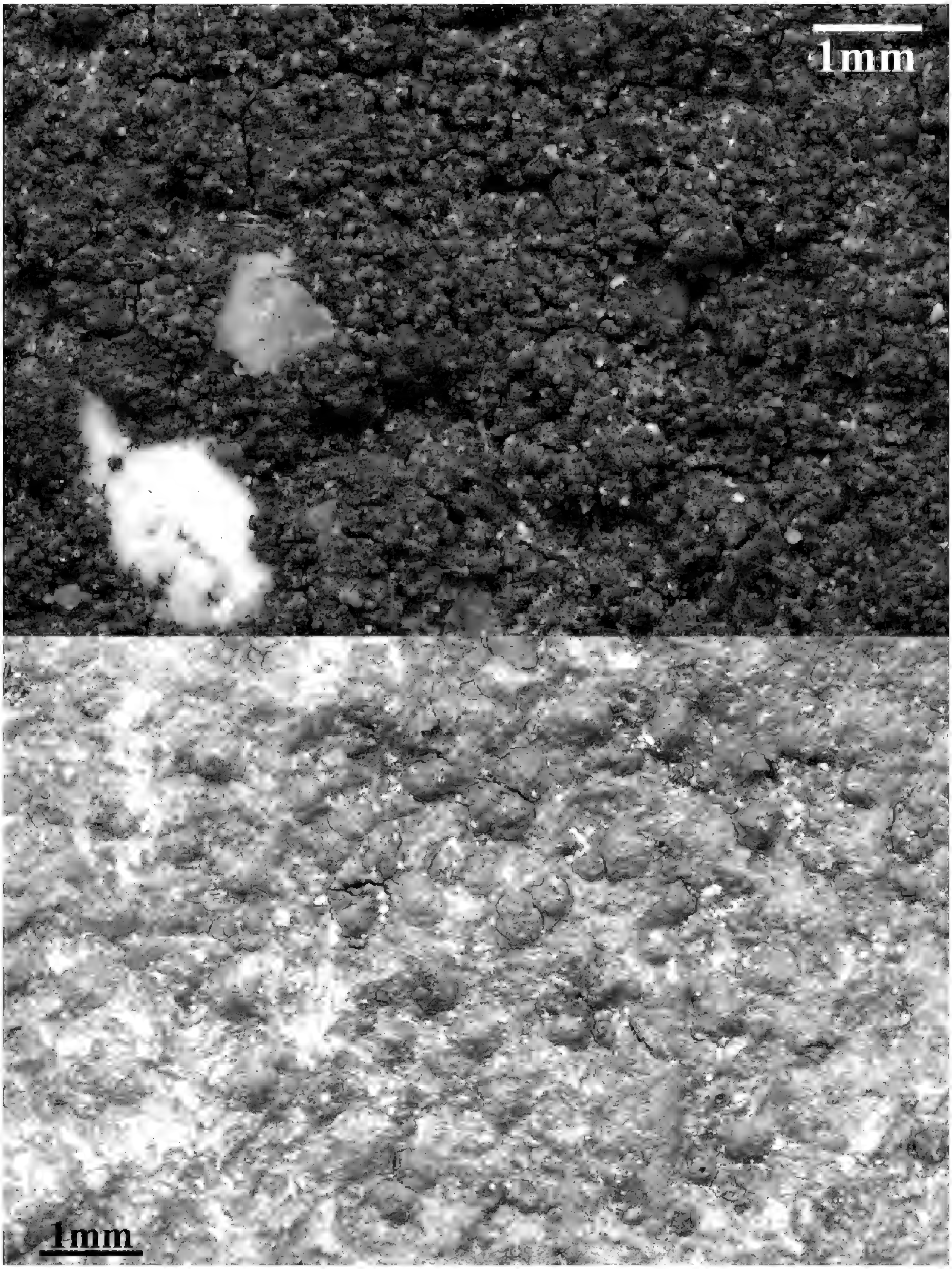

Figure 40. Photographs of selected species of San Bernardino National Forest lichens. Top: *Verrucaria furfuracea* (*Knudsen 8284*, UCR). Bottom: *Verrucaria margacea* (*Knudsen 15824*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

***Verrucaria turgida* Servít SJ**

NOTES. – This brown areolate *Verrucaria* is infrequent in southern California. There are two collections from the San Jacinto Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Idyllwild, 33°43′36"N 116°45′3"W, 1602 m, 4.viii.2005, on flat granite rock at soil level, K. *Knudsen 34445.1* (UCR; det. O. Breuss).

***Vestergrenopsis sonomensis* (Tuck.) T.Sprib. & Muggia SJ**

NOTES. – This effigurate cyanolichen is rare in southern California. It is known from a single collection made in San Jacinto Mountains. For photographs refer to McCune and Geiser (2009) and Sharnoff (2014) under the name *Koerberia sonomensis* (Tuck.) Henssen. We follow Spribille and Muggia (2013) and treat the species in *Vestergrenopsis*.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′49"N 116°44′24"W, 1650 m, 6.x.2008, on granite, *J.C. Lendemer 14835A & K. Knudsen* (NY).

***Xanthocarpia crenulatella* (Nyl.) Frödén, Arup & Søchting SB, SJ**

NOTES. – This is a common species in southern California on calcareous rocks, granite in drainages, and on cement. For a photograph refer to Sharnoff (2014) under the name *Caloplaca crenulatella* (Nyl.) Olivier. Note that we follow Arup et al. (2013) and treat the species in *Xanthocarpia*.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′12"N 116°47′27"W, 1902 m, 9.vi.2004, on dolomite, *K. Knudsen 3371B* (UCR).

***Xanthomendoza fallax* (Hepp *ex* Arnold) Søchting, Kärnefelt & S.Y.Kondr. SB**

NOTES. – This species appears to be infrequent in the San Bernardino Mountains. It is expected to also occur in the San Jacinto Mountains. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, above Hwy. 330, 34°12′25"N 117°08′57"W, 1508 m, 11.vi.2013on scattered *Quercus kelloggii*, *K. Knudsen 15841* (UCR).

***Xanthomendoza fulva* (Hoffm.) Søchting, Kärnefelt & S.Y.Kondr. SB, SJ**

NOTES. – This is the most common *Xanthomendoza* on oaks in San Bernardino National Forest. It is commonly seen covering *Alnus rhombifolia* along the Santa Ana River, golden in the morning light. For a photograph refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Seven Oaks Rd., along the Santa Ana River, 34°10′06"N 117°00′52"W, 1729 m, 13.vii.2015, covering trunk of *Alnus, K. Knudsen 17549* (FH, UCR).

***Xanthomendoza galericulata* L.Lindblom SB**

NOTES. – This species is rare in the San Bernardino Mountains where it is known from a single collection on alder bark.

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, N-facing slope above Hwy. 38, 34°09′06"N 116°56′10"W, 771 m, 6.xi.2014, on *Alnus* bark, *K. Knudsen 17309 & J. Kocourková* (UCR).

***Xanthomendoza hasseana* (Räsänen) Søchting, Kärnefelt & S.Y.Kondr. SJ**

NOTES. – This species is frequent in the San Jacinto Mountains from Humbar Park to Lake Fulmar. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Humbar Park, 1680 m, 5.iv.1977, on trunk of *Quercus kelloggii*, *L. Tibell 7743* (ASU; det. L. Lindblom).

***Xanthomendoza mendozae* (Räsänen) Søchting, Kärnefelt & S.Y.Kondr. SJ, SB**

FIG. 41B

NOTES. – This species grows in rock crevices, usually on large granite boulders, and is infrequent in San Bernardino National Forest.

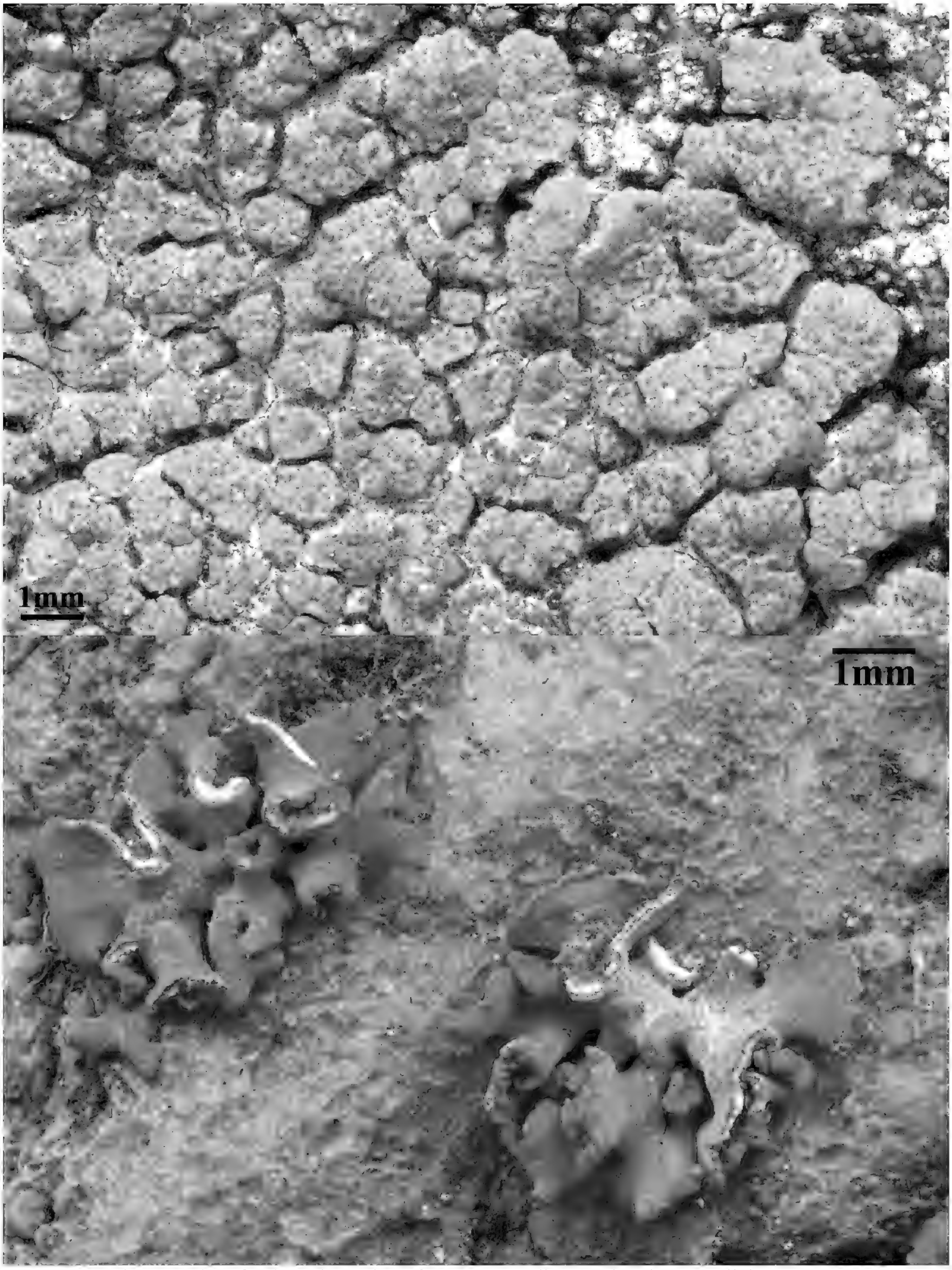

Figure 41. Photographs of selected species of San Bernardino National Forest lichens. Top: *Verrucaria othmarii* (*Knudsen 17021*, UCR). Bottom: *Xanthomendoza mendozae* (*Knudsen 10414*, UCR). Photographs by Tim Wheeler (copyright, U.S. National Forest Service).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Devil's Slide, near Middle Spring, 33°46′35"N 116°40′41"W, 2321 m, 23.vii.2004, on granite, *K. Knudsen 1526* (UCR).

***Xanthomendoza montana* (L.Lindblom) Søchting, Kärnefelt & S.Y.Kondr. SB, SJ**

NOTES. – This species is frequent in the San Bernardino National Forest. For a photograph refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′16"N 116°47′16"W, 1869 m, 7.vi.2005, on rough bark of main stem of *Ephedra* bush, *K. Knudsen 3326B* (NY, UCR).

***Xanthomendoza trachyphylla* (Tuck.) Frödén, Arup& Søchting SB**

NOTES. – This common calciphile occurs on limestone at Cactus Flats in the San Bernardino Mountains. For an image refer to Sharnoff (2014) under the name *Caloplaca trachyphylla* (Tuck.) Zahlbr. Note that we follow Arup et al. (2013) and treat the species in *Xanthomendoza*.

Selected specimens examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Cactus Flats, 34°18′27"N 116°47′28"W, 1859 m, 7.vi.2005, on granite in mixed granite-limestone drainage, *K. Knudsen 3316 & M. Knudsen* (NY, UCR).

***Xanthomendoza ulophyllodes* (Räsänen) Søchting, Kärnefelt & S.Y.Kondr. SJ**

NOTES. – This species is frequent in the San Jacinto Mountains. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, E side of Palm View Peak, 33°40′09"N 116°34′32"W, 2054 m, 13.viii.2005, on bark of *Quercus kelloggii, K. Knudsen 3488* (UCR).

***Xanthoparmelia coloradoënsis* (Gyeln.) Hale SB, SJ**

NOTES. – This commonly fertile species lacks lichenized propagules and is frequent in the San Jacinto Mountains (Thomas Mountain-Garner Valley area) and infrequent in San Bernardino Mountains in the watershed of the Santa Ana River. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Fish Creek trail area, 34°08′54"N, 116°46′19"W, 2164 m, 7.x.2008, on granite, *J.C. Lendemer 14945 & K. Knudsen* (UCR).

***Xanthoparmelia cumberlandia* (Gyeln.) Hale SB, SJ**

NOTES. – This species is common in southern California at elevations below 2000 meters. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, near FS 4S21, midway to Vista Point, 33°46′57"N, 116°46′53"W, 1685 m, 6.x.2008, on granite, *J.C. Lendemer 14873 & K. Knudsen* (NY).

***Xanthoparrmelia lavicola* (Gyeln.) Hale SB**

NOTES. – This is a rare isidiate desert species in southern California, which is common in Arizona. It is apparently rare in the San Bernardino National Forest.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Holcomb Valley, 34°18′37"N 116°53′58"W, 2129 m, 18.xi.2014, on granite, *K. Knudsen 17089 & J. Kocourková* (UCR).

***Xanthoparmelia lineola* (E.C.Berry) Hale SB, SJ**

NOTES. – This tightly adnate species is usually fertile and always lacks lichenized propagules. It is common in the San Bernardino National Forest. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Onyx Summit, 34°12′29"N 116°43′03"W, 2635 m, 7.x.2008, on granite, *J.C. Lendemer 14898 & K. Knudsen* (UCR).

Xanthoparmelia loxodes **(Nyl.) O.Blanco et al. SB**

NOTES. – This brown species is rare in the San Beranrdino Mountains and the collection cited below, made by the great American lichenologist T.L. Esslinger, is the only record from San Bernardino National Forest. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, W of the northern arm of Baldwin Lake, along Hwy. 18, 2075 m, 30.vii.1994, on granite, *T.L. Esslinger 13856* (hb. Esslinger).

Xanthoparmelia maricopensis **T.H.Nash & Elix SJ**

NOTES. – This species is common in Arizona and its distribution extends across the desert into southern California, where it is especially common in the Mojave Desert in Joshua Tree National Park. It is only known from the San Jacinto Mountains from one collection. For photographs refer to Knudsen et al. (2013a) and Sharnoff (2014).

Specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Pinyon Pine campground, 1217 m, 16.vi.1966, on granite, *C.M. Wetmore 14563* (MIN; det. T.H. Nash).

Xanthoparmelia mexicana **(Gyeln.) Hale SB, SJ**

NOTES. – This isidiate species is probably the most common member of the genus in southern California and in the San Bernardino National Forest. For photographs refer to Knudsen et al. (2013a) and Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, W of Burnt Mill Canyon, 34°16′25"N 117°19′07"W, 1107 m, 15.xi.2014, on granite, *K. Knudsen 17075 & J. Kocourková* (UCR).

Xanthoparmelia novomexicana **(Gyeln.) Hale SB, SJ**

NOTES. – This commonly fertile species that lacks lichenized propagules and produces fumaprotocetraric acid is rare in the San Bernardino National Forest as well infrequent in southern California. For a photograph refer to see Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Waterman Canyon, 34°12′26"N 117°17′09"W, 881 m, 23.xii.2014, on granite, *K. Knudsen et al. 16377* (UCR).

Xanthoparmelia oleosa **(Elix & P.M.Armstr.) Elix & T.H.Nash SB, SJ**

NOTES. – This commonly fertile species that lacks lichenized propagules and produces fatty acids is infrequent in San Bernardino National Forest.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Thomas Mountain, 33°35′19"N 116°37′57"W, 1584 m, 11.i.2008, on granite, *J.C. Lendemer 11371 & K. Knudsen* (NY).

Xanthoparmelia plittii **(Gyeln.) Hale SB, SJ**

NOTES. – This isidiate species is infrequent in San Bernardino National Forest. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, FS 2N93 off CA 38, 34°10′29"N 116°47′11"W, 2274 m, 7.x.2008, on granite, *J.C. Lendemer 14920 & K. Knudsen* (NY).

Xanthoparmelia subdecipiens **(Vain.) Hale SB**

NOTES. – This fertile species is rare in the San Bernardino Mountains but appears to be frequent in the San Gabriel Mountains. The collection cited below was made by M.E. Hale, the monographer of *Xanthoparmelia* and first author of a modern lichen flora of California.

Selected specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Big Bear valley, elevation not given, 4.xii.1980, [probably on granite], *M.E. Hale 56033* (US).

Xanthoparmelia subplittii **Hale SB**

NOTES. – This is generally a lower elevation species in the desert and near the Mexican border in San Diego County. It is known in the San Bernardino National Forest from a single collection made on Onyx Summit by T.H. Nash III.

Specimen examined. – **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, Onyx Summit, 2750 m, 9.viii.1975, on granite, *T.H. Nash III 11259* (ASU).

Xanthoparmelia subramigera **(Gyeln.) Hale SB, SJ**

NOTES. – This species is frequent in southern California but has an infrequent distribution in the San Bernardino National Forest. For a photograph refer to Sharnoff (2014).

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, above Pacific Crest Trail, 33°34′18"N 116°34′10"W, 1491 m, 8.v.2005, on granite, *J.C. Lendemer 4122 & K. Knudsen* (PH, UCR).

Xanthoparmelia verruculifera **(Nyl.) O.Blanco et al. SB, SJ**

NOTES. – This is the common brown isidiate species in southern California. For a photograph refer to Sharnoff (2014).

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Black Mountains, 33°44′23"N 116°45′30"W, 2337 m, 22.ix.2003, on granite, *K. Knudsen et al. 489.2* (UCR).

Xanthoparmelia weberi **(Hale) Hale SJ**

NOTES. – This species is common in the Sonoran Desert in Arizona and Mexico. Its distribution extends into southern California in the Sonoran Desert. It occurs in Henderson Canyon in Anza Borrego Desert State Park (*Knudsen 9544*, NY, UCR; det. J.C. Lendemer). There are two collections from the Sonoran side of the San Jacinto Mountains made by C.M. Wetmore (Chino Canyon and Palm Canyon, both det. by T.H. Nash III)

Selected specimens examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, Chino Canyon, elevation not stated, 17.vi.1966, on granite, *C.M. Wetmore 14609* (ASU, MIN; det T.H. Nash III).

Xanthoparmelia wyomingica **(Gyeln.) Hale SJ**

NOTES. – This montane species is infrequent in southern California and rare in the San Jacinto Mountains.

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, San Jacinto Wilderness, off trails in forest SE of Reeds Meadow, 33°46′08"N 116°39′23"W, 10.vii.2006, 2438 m, on granite, *K. Knudsen 6847* (UCR).

Xylographa difformis **Vain. SJ**

NOTES. – *Xylographa difformis* is here reported new for California from the San Jacinto Mountains. For a description and photographs refer to T. Spribille et al. (2014)

Selected specimen examined. – **U.S.A. CALIFORNIA.** RIVERSIDE CO.: San Jacinto Mountains, North Fork of San Jacinto River, 33°47′50"N 116°44′23"W, 1576 m, 9.v.2005, on wood, *J.C. Lendemer 4141 & K. Knudsen* (UCR).

Part V: Excluded Species

Lecanora mughicola **Nyl. SJ**

NOTES. – The only report for California was misidentified (Knudsen & Kramer 2007) and the species it is not recognized as occurring in California.

Stromatella bermudana **(Riddle) Henssen SJ**

NOTES. – This cyanolichen is a rare calciphile (Schultz 2002). It was reported from San Jacinto Mountains from one collection by C.M. Wetmore (ASU) as a dot in Sonoran flora (Nash et al. 2002). This collection is apparently lost at ASU (W. Fertig, pers. comm.) and no duplicates corresponding to the collection number could be located nor is it known who determined it but it was not the author of the

treatment M. Schultz (CNALH 2015). Knudsen (2003) reported it from San Jacinto Mountains but his collection was revised as an unknown. This species is not recognized as occurring in California.

***Thelidium microbolum* (Tuck.) Hasse SB**

NOTES. – H.E. Hasse reported *Thelidium microbolum* from 1300 meters on reconsolidated limestone in Mill Creek Canyon (Hasse 1913). It is an undescribed *Lichenothelia* species (FH!).

CONCLUSION

In the first phase of lichenological discovery in the San Bernardino and San Jacinto Mountains (1890–1955), pioneer California lichenologist H.E. Hasse collected lichens beginning in the 1890′s until probably 1911 (Hasse 1906, 1913). The historical record is primarily based on about 225 collections made H.E. Hasse located in North America herbaria (CNALH 2015). The only known lichenologists to visit the mountains between 1915 (the year of Hasse′s death) and 1955 were D.A. Darrow and S. Shushan.

Beginning in 1955, with H.A. Imshaug collecting on the summits of San Jacinto Peak and San Gorgonio, there was a second phase of lichenological discovery in San Bernardino National Forest (1955-2004). More than a dozen lichenologists skimmed through the mountains, including C.C. Bratt, T.L. Esslinger. M.E. Hale, T.H. Nash, B. Owe-Larsson, R. Reifner Jr., B.R. Ryan, L. Tibell, E. Timdal, and C.M. Wetmore. Overlapping with the third period, the first author (KK) collected Acarosporaceae. Information pertaining to the lichens of the region that was published in the treatments of the *Lichen Flora of the Greater Sonoran Desert Region* (Nash et al. 2002, 2004, 2007) is based primarily on the work of the aforementioned collectors. An important study of this second period was *The Lichen Family Heppiaceae in North America* by Wetmore (1970) which included his discoveries from the San Jacinto Mountains and in this paper we cite many of his collections in honor of his contribution to North American lichenology.

In 2003, the first author (KK) started a lichen herbarium at UCR with a regional and historical focus on southern California. He began a third phase of lichen discovery in the San Bernardino National Forest commencing with weekly field trips with the Forest Service. He made approximately 1500 collections deposited in ASU, PH, NY, and UCR. He was joined by JC. Lendemer from 2004 to 2008 to collect in both mountain ranges, and Lendemer made over 400 collections that have been deposited in PH, NY, and UCR. Other recent collectors included in this study are M. Crawford, M. Harding, J. Kocourková, A.R. Pigniolo, and M. Schultz.

In this paper we document 414 taxa of lichenized fungi from the San Bernardino National Forest. In the San Jacinto Mountains (including the Santa Rosa Mountains), 327 lichen taxa occur. Of those 327 taxa, 125 taxa have not been collected in the San Bernardino Mountains. A total of 289 lichen taxa have been collected in the San Bernardino Mountains, of which 87 have not been collected in the combined San Jacnito-Santa Rosa Mountains. The most speciose genera in the study area are *Acarospora* (22 species), *Lecidea* (18 species), *Lecanora* (24 species), *Rhizocarpon* (14 species), *Rinodina* (17 species) and *Xanthoparmelia* (16 species). The majority of lichen taxa in San Bernardino National Forest are crustose and occur on rock, usually in mixed communities. Due to low relative annual humidity and high fire frequency, the lichen biota on the bark and wood of conifers and oaks as well as chaparral has a low diversity of macrolichens and crusts. Small sorediate macrolichens, like *Xanthomendoza* and *Physconia* species, are presumed to be fast growing pioneers well adapted to arid climates and frequent fires, and they predominate in the region. The most common crustose lichens on bark and wood are species of *Lecanora* and *Rinodina*. Fruticose lichens, such as *Bryoria* or *Usnea*, are rare due to low annual relative humidity or have been extirpated. Soil crusts are frequent throughout the mountains, but nowhere are abundant. Moss-*Cladonia* soil crusts are rare, with two species of *Cladonia, C. acuminata* and *C, cariosa,* having been found sterile and never producing podetia. Soil crusts of *Acarospora nodulosa, Heppia conchiloba* and *H. adglutinata* on the flood plain of the main canyons on the Sonoran side of the San Jacinto Mountains were already rare in Hasse′s time (Hasse 1913) and have been apparently extirpated by the development of the Palm Springs area. Riversidian soil crusts are frequent on the west slope of the San Jacinto Mountains (for a description of this soil crust community see Hernandez & Knudsen 2012). Since the 1890s, 17 species have been described from the San Jacinto Mountains: *Acarospora epilutescens, A. oreophila, Aspicilia brucei, A. cyanescens, A. fumosa, A. knudsenii, A. peltastictoides, A. phaea, Gloeoheppia squamulosa,* ***Heppia conchiloba, Lecanora austrocalifornica, L. peninsularis, Lecidea oreophila, Peltula obscurans*** var. *hassei, Psorotichia hassei, Ramonia gyalectiformis,* and *Ramonia vermispora*. Five species have been

described from the San Bernardino Mountains: *Acarospora brodoana, Lecanora remota, Lecidea stratura, Rhizocarpon dimelaenae* and *Verrucaria bernardensis.*

Five species are here reported new for North America and California: *Gloeoheppia rugosa*, *Lecanora formosa*, *Peccania cernohorskyi*, *P. corallina* and *Psorotichia vermiculata.* All five species occur in Europe**.**

Eight species are reported new for California: *Caloplaca diphasia, C. isidiigera, Peltigera extenuata, Rhizocarpon simillimum***,** *Rinodina lobulata***,** *R. terrestris, Sarcogyne squamosa,* and *Xylographa difformis.* Except for *Caloplaca diphasia*, which has its center of diversity in Mexico, these are species that are Holarctic in distribution and these records represent southern range extensions in California. This pattern is common in the lichen biota of San Beranrdino National Forest with many species being much more common in the Sierra Nevada Mountains or farther north.

Thirteen species have not been collected in the San Bernardino National Forest since the 1940s: *Acarospora epilutescens, Aspicilia peltastictoides, Gloeoheppia squamulosa, Heppia conchiloba, Polycauliona ignea, P. luteominia* var. *bolanderi, Protoparmelia ochrococca, Ramalina farinacea, R. menziesii, Rinodina badiexcipula, R. milvina, Thelocarpon hassei,* and *Usnea cavernosa.* The majority of these species are rare in southern California but may be rediscovered.

Many species would have thrived in southern California during the Pleistocene when there was a moister climate. At the end of the Pleistocene, as a Mediterrean climate developed in southern California, these species recolonized the north from retreating glaciers as they died out in the southern part of their range, leaving behind relic populations in southern California (Knudsen & Crawford 2014, Knudsen & Kocourková 2015). *Usnea cavernosa* is probably extirpated from southern California. *Bryoria fremonti* is almost extirpated from its southern most location. Several rare relics, like *Baeomyces rufus*, will probably be extirpated in the 21st century with a changing climate and more frequent fires (Knudsen & Kocourková 2015). *Placynthiella dasaea* may have been extirpated in the fire of 2015.

The current distribution of lichens in San Bernardino National Forest is almost certaintly the effect of long term geological and climatic change. Rapid anthropogenic climate change and fires combined with the fragmentation of habitats by development, especially urbanization around the base of the mountains, will probably cause a long term loss in species diversity. The major threat to lichens in the San Bernardino National Forest is fire. Frequent or catastrophic fires are leaving large areas of the mountains empty of lichens. Land devastated around Cajon Pass in the San Bernardino and San Gabriel Mountains in fires in the 1990s are still lacking any lichen cover more than two decades later. In the San Jacinto Mountains, a catastrophic fire in the Black Mountain area or the North Fork of the San Jacinto River, would cause a substantial loss in species diversity.

A floristic study is always a snapshot in time, of both nature and our knowledge of nature. This is a picture at the beginning of the 21st century in the early Anthropocene. We do not feel we have documented the full diversity of lichens in San Bernardino National Forest. This is because the majority of lichens have scattered infrequent distributions in southern California as well as many species being rare. The area of the San Jacinto and San Bernardino Mountains is immense, over 3,334 km² (5400 mi²), with many microhabitats. It takes intuitive and wide-ranging fieldwork with a lot of hiking to capture the full diversity of lichens in southern California. Logistical support and funding are also required. If further work is carried out, new discoveries would be expected. Nonetheless this checklist establishes a solid baseline for future lichenological and ecological work in the region.

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A new circumscription for the common and widespread North American species *Physcia subtilis*, and description of a new species, *P. thomsoniana*

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ABSTRACT. – The common eastern North American species *Physcia subtilis* is shown to be heterogeneous and to consist of at least two distinct species, one of them smaller, with consistently narrow lobes and a top to bottom paraplectenchymatous thallus anatomy, and the other an often larger species, with lobes varying from narrow to considerably broader, and a more typical thallus anatomy with a medulla composed of distinct hyphae. Based on the type material and protologue, the name *P. subtilis* belongs to the less common, smaller species, and the other taxon is here described as the new species, *P. thomsoniana*.

KEYWORDS. – Eastern North America, macrolichens, Physciaceae, taxonomy, thallus tissues.

INTRODUCTION

As currently circumscribed, *Physcia subtilis* Degel. is one of the most common saxicolous members of the genus in central and eastern North America. It has generally been recognized as a highly polymorphic species, and included within its present circumscription are variants from small, narrow-lobed (ca. 0.1 mm wide), closely appressed specimens all the way to much larger, broader-lobed (up to 0.5 mm or rarely even 1.0+ mm wide) specimens which commonly grow loose enough to be easily collected off the substrate (Brodo et al. 2001, Thomson 1963).

According to the protologue (Degelius 1940), the thallus of *Physcia subtilis* is supposed to be composed of paraplectenchymatous tissue from top to bottom, and most subsequent descriptions or characterizations of the species (e.g., Brodo 1968, 2016; Hinds & Hinds 2007; Showman & Flenniken 2004; Taylor 1967; Thomson 1963, 2003; Wetmore 1967) have repeated that feature as characteristic of the species. Early in my studies of the North American *Physciae*, I was struck by the fact that the wide selection of supposed *P. subtilis* specimens that I had sectioned over the years all had a rather typical thallus anatomy for a foliose lichen, with a well-organized and delimited upper cortex (paraplectenchymatous in this case), a medulla composed of distinctive hyphae, which are often rather dense and tend to be oriented parallel to the long axis of the lobes, and a well-organized and delimited lower cortex (also largely paraplectenchymatous). This inconsistency between what I expected and what I observed for *P. subtilis* was mentioned in my paper describing the new species, *P. dakotensis* Essl. (Esslinger 2004).

At that time I had begun to suspect that the original reports of a paraplectenchymatous thallus in *Physcia subtilis* were based on some type of error, either in sectioning or in interpretation. In an attempt to resolve this problem, I arranged to borrow and study the rich collection (ca. 300 specimens) of material identified as *P. subtilis* from NY. Based on my study of the NY specimens, as well as many from ASU and KANU, and also restudy of the specimens in my own herbarium, I have concluded that the confusion was caused by the occurrence of (at least) two separate taxa within the present concept of *P. subtilis*. One of these taxa is less common and less widespread and has small, narrow-lobed and closely appressed thalli which consist totally or largely of paraplectenchymatous tissue. The other taxon is a more common and more widespread species with (generally) larger and broader lobed thalli, which are weakly or not

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appressed (and often ascending or mat forming in parts) and which have a well-developed medulla composed of typical hyphae, often rather dense.

Based on the protologue (Degelius 1940) and my study of the pertinent type specimens (cited below), it's quite clear that the name *Physcia subtilis* corresponds to the former of these two taxa, i.e., the smaller, closely appressed species with a paraplectenchymatous thallus anatomy. The other taxon apparently lacks a name, and is described here as a new species, named in honor of John W. Thomson, in recognition of his pioneering work on North American Physciaceae. Although today John's treatment (Thomson 1963) of the North American species of *Physcia* (*sensu lato*) has become very dated, when published it was one of the very first modern treatments of any major (or minor) group of North American lichens. A full description and discussion for *P. thomsoniana* is given below and for comparative purposes, a description and discussion is also provided for *P. subtilis*.

MATERIALS AND METHODS

More than 500 specimens were studied for this paper, most of which had originally been identified as *Physcia subtilis*. All were studied in dry condition under an Olympus SZ40 dissecting microscope. The microscopic features were studied and measured in water mounts on a Nikon Alphaphot YS2 compound microscope, sometimes with added lactophenol cotton blue as a dye. Thallus anatomy was studied in nearly all studied specimens of *P. subtilis* and in a large number of the *P. thomsoniana* specimens, using free hand longitudinal sections of the lobes and occasionally, whole mounts of the lower cortex in surface view, with upper cortex and medulla chipped away. The habit photographs were taken using the dissecting microscope, with either a Nikon Coolpix 8700 digital camera or a Nikon D7000 digital camera mounted on it. Thin-layer chromatography using three solvent systems was carried out using the standardized methods of Culberson & Kristinsson (1970) and Culberson (1972). For the specimen citations, one specimen from each county was selected for citation.

TAXONOMIC SECTION

Physcia thomsoniana **Essl. sp. nov.**
MYCOBANK #820032.

FIGURES 1 AND 2.

TYPE: U.S.A. SOUTH DAKOTA. MINNEHAHA CO.: S edge of Dell Rapids, Dells of the Big Sioux River, 43.81919°N, 96.71686°W (determined by GPS), elev. 1500 ft., large Sioux quartzite outcrops (flat ground-level and vertical cliffs) along river, riparian deciduous woodland, locally abundant; 11.xii.2015, *M.K. Advaita 19303* (KANU!, holotype; herb. Esslinger!, isotype; further isotypes will be distributed in *Lichenes Exsiccati Magnicamporum*).

DESCRIPTION. – Thallus foliose, more or less orbicular to more irregular, moderately to loosely appressed, weakly adnate to more or less loose and easily removed from the substrate, up to ca. 4 or 5 cm in diameter but more often smaller, sometimes coalescing into larger colonies. Lobes elongate and discrete, (0.15–) 0.2–0.5 (–1.0) mm broad, or becoming more flabellate and imbricate or tangled, more or less flat to somewhat convex. Upper surface white to gray-white, very weakly or not maculate, mostly smooth and without pruina. Narrow lobed, adnate thalli often have terminal and/or marginal blastidia formed on peripheral lobes, with or without more blastidia or isidioid granules internally, the broader lobed, imbricate and cushion-forming thalli often have blastidia and more or less abundant coarsely granular soredia on and under upturned lobe ends/edges. Lower surface white to off-white or tan, flat to very weakly concave, sparsely (especially in narrow-lobed thalli) to moderately rhizinate, the rhizines short to more conspicuous and well developed, concolorous with the lower surface or darkening somewhat, simple to sparsely furcate.

Thallus (80–) 100–180 (–230) µm thick, medulla well developed and composed of hyphae which are often fairly dense and parallel (in thick sections, sometimes appearing almost like prosoplectenchymatous tissue), lower cortex 10–25 µm thick, distinctly paraplectenchymatous (lumina 3–7 µm, rounded to somewhat angular) and more or less clearly delimited from the medulla, or, composed of paraplectenchyma (lumina 1.5–5 µm) mixed with areas of irregular prosoplectenchyma or with only scattered, intruding hyphae, and then sometimes less distinctly delimited from the medulla.

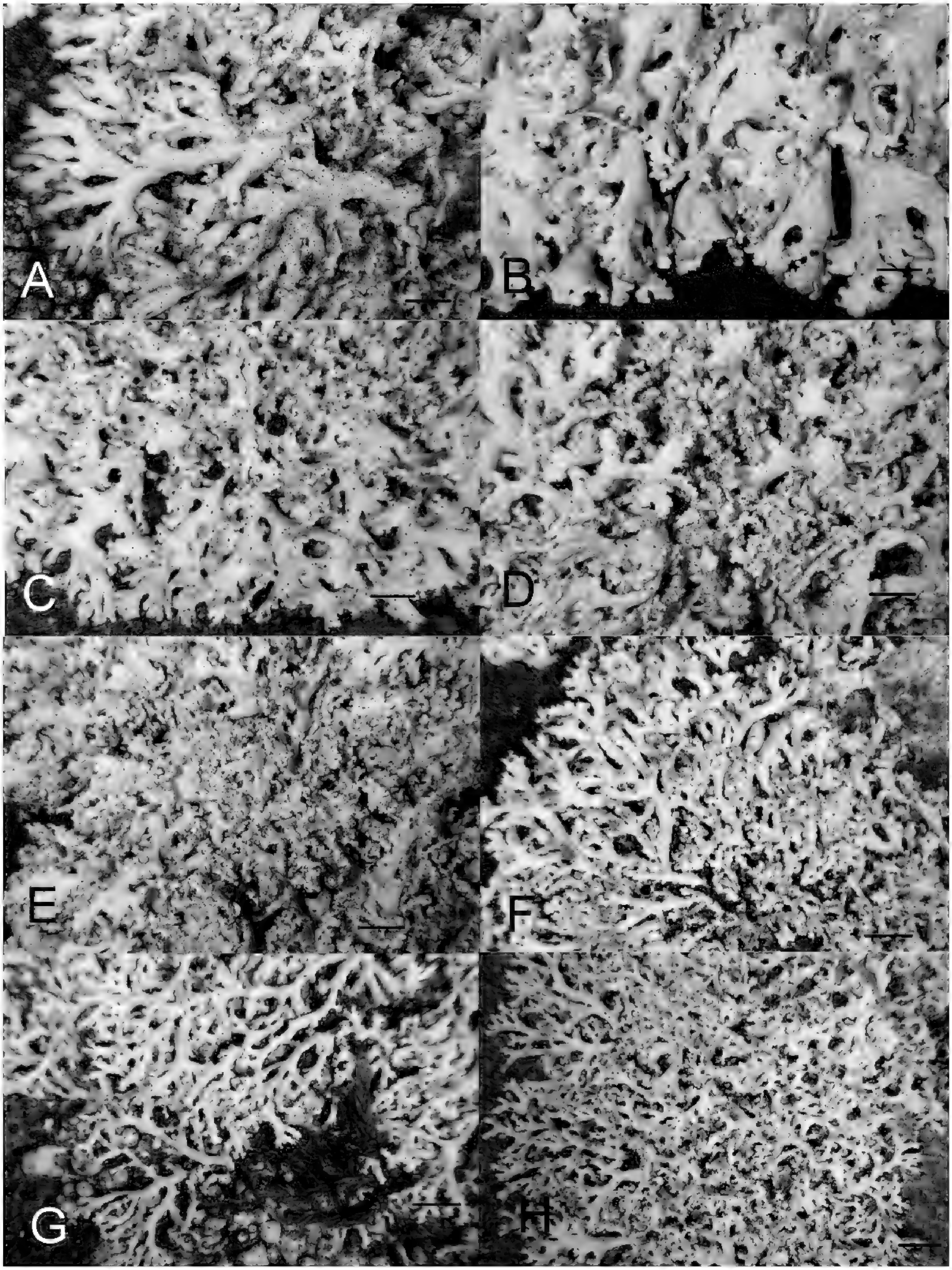

Figure 1, *Physcia thomsoniana*. **A**, portion of the holotype, *Advaita 19303* (KANU) from South Dakota. **B**, *Dey 5203* (NY) from North Carolina. **C**, *Lendemer 19490* (NY) from Pennsylvania. **D**, *Esslinger 11753* (herb. Esslinger) from Minnesota. **E**, *Esslinger 3493* (herb. Esslinger) from North Carolina. **F**, *Lendemer 6701* (NY) from Missouri. **G**, *Lendemer 24294* (NY) from Pennsylvania. **H**, *Lendemer 24242* (NY) from Pennsylvania. Scales all equal 1 mm.

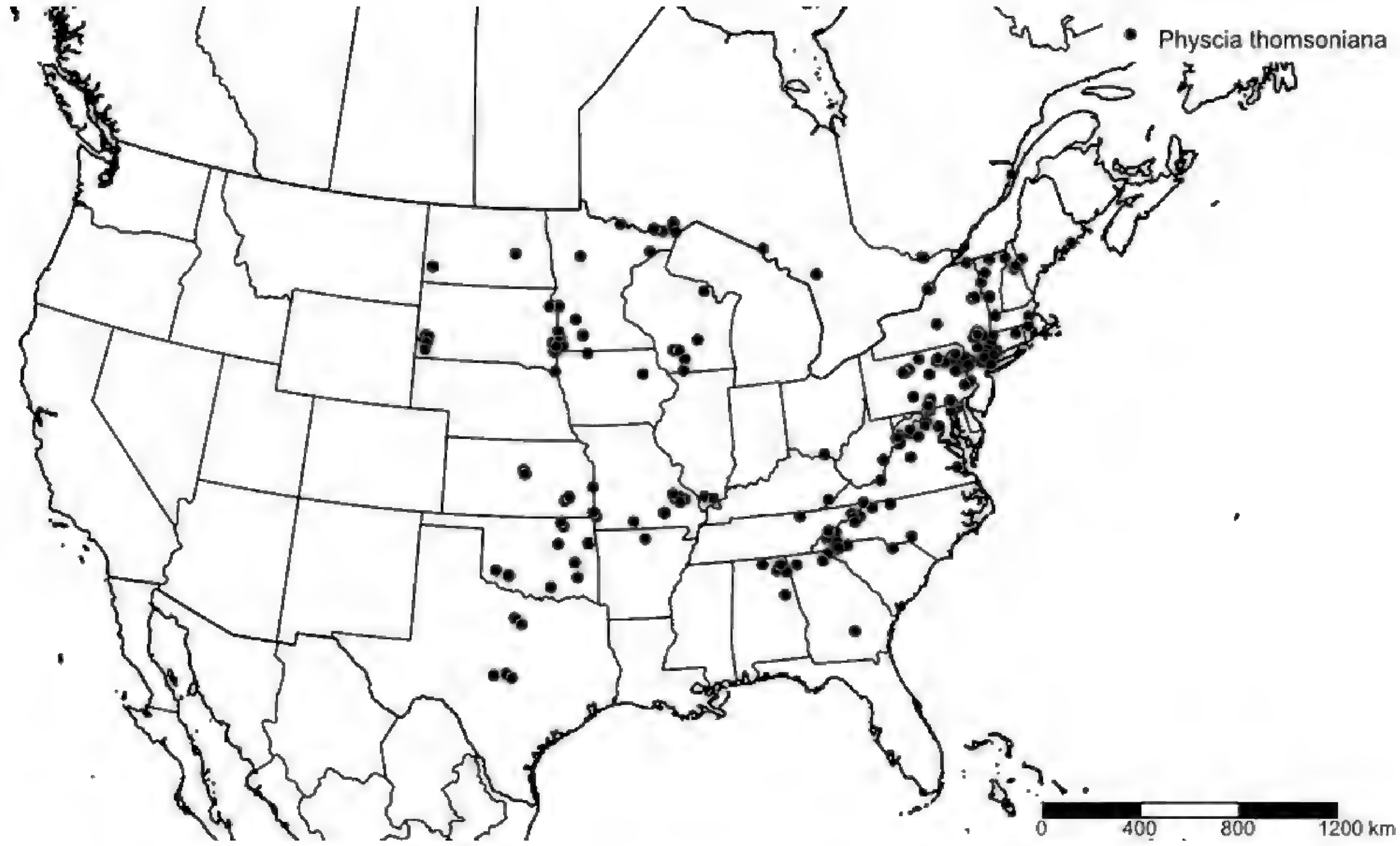

Figure 2. Geographic distribution of *Physcia thomsoniana* based on specimens examined for this study.

Apothecia occasional and sometimes rather numerous, mostly up to ca. 1 mm but occasionally larger, disk more or less flat, black, epruinose, exciple entire or becoming finely crenate, larger apothecia sometimes developing granules or blastidia on the margin; ascospores (12–) 13–17 (–19) × 6–8 (–9) µm, essentially *Physcia*-type although the lumina sometimes become a bit more rounded. Pycnidia frequent, black and conspicuous, flush to slightly emergent, conidia bacilliform to very weakly bifusiform, 3–5 × <1 µm.

CHEMISTRY. – Atranorin, presumably only in the upper cortex. Spot tests: upper cortex: K+ yellow, P+ pale yellow, C-, KC-; medulla: K-, P-, C-, KC-.

ETYMOLOGY – Named in honor of John W. Thomson, student of the Physciaceae, my lichenological 'grandfather' [i.e., my major professor's (William Louis Culberson) major professor], and someone who helped many novice lichen enthusiasts, including me, get started working on lichens.

ECOLOGY – This species grows primarily on non-calcareous rock in open or somewhat shady habitats, but very rarely it can occur on bark (only a single specimen on bark was seen in this study).

DISCUSSION. – *Physcia thomsoniana* has been confused with, and included in, the concept of *P. subtilis* ever since the description of that species by Degelius 75 years ago. Although the gross morphology can generally be used to distinguish the two species, it does overlap somewhat, meaning one must rely on their anatomical differences for most small and closely appressed specimens. In *P. subtilis*, the thallus tissue, from upper cortex to lower cortex, including the regions of the algal layer and medulla, is composed entirely or largely of paraplectenchymatous tissue, whereas *P. thomsoniana* has a more typical thallus anatomy, with clearly delimited upper and lower paraplectenchymatous cortices and a medulla composed of distinctive hyphae which are usually rather dense and oriented parallel to the long axis of the lobes. Their differences can be summarized as follows:

In *Physcia subtilis sensu stricto*, the thalli are small, often 0.5–1.5 cm (rarely up to 2 cm), closely **appressed (NOT** removable from substrate as a useful specimen!) but with lower cortex and sparse peg-like rhizines even on more central thallus areas (unlike *P. dakotensis*), with lobes (0.08–) 0.1–0.2 (occasionally to 0.3 at branch points or flabellate ends) mm wide, linear-elongate or somewhat flabellate at ends, discrete to more or less contiguous; the thallus is composed of **paraplectenchyma** (roundish cells) from top to bottom (very rarely some cells tend to be horizontally elongate or a few sparse, scattered

hyphae will be present). In *Physcia thomsoniana*, the thalli can be equally small but also often grow to 2–3 cm (and rarely more), and often coalesce into larger colonies; lobes linear-elongate to distinctly flabellate, (0.1–) 0.2–0.5 (–1.0) mm wide; the smaller, narrower lobed thalli are often prostrate and may appear closely appressed (but upon close inspection, the thalli can usually be seen to be elevated so that you can see a thin space between substrate and thallus, and you may see short rhizines peeking out); the larger thalli often become distinctly three-dimensional, with upturned and or ascending and entangled lobes, often forming 'cushions' (such specimens are nearly always removed from the substrate when collected); the thallus consists of typical tissues, the upper and lower cortices paraplectenchymatous (but the lower often with few to more numerous intruding hyphae present), and the **medulla distinctly hyphal**, often densely so.

Physcia thomsoniana exhibits significant variability in the anatomy of the lower cortex. Rarely, it is very distinctly paraplectenchymatous (with no obvious hyphae), with a mixture of nearly round to vertically elongate and irregular cells in which the lumina are 3–7 (rarely up to 10) µm in largest dimension. More commonly, longitudinal sections of the lower cortex show somewhat smaller celled paraplectenchyma with roundish to angular cells (lumina mostly 2–5 µm) with few to many areas of intruding hyphae. In an effort to better understand this variable lower cortex anatomy, surface view slides were prepared using a razor blade to chip away the upper cortex and as much medulla as possible from a piece of lobe (to increase light transmission), which was then mounted on a slide (usually with lactophenol cotton blue) to show the lower cortex in surface view. In these preparations, the cortex appears to have few to many, variously scattered paraplectenchyma cells embedded in multi-directional hyphae. In the most extreme form of this cortex type, the rounded to angular cells are rather few and far between, leaving a cortex largely composed of hyphae, which, however, are swirled appearing in surface view and in longitudinal sections can be seen to be distinctly non-parallel with the long axis of the lobe (i.e. they are multi-directional). When seen only in sectional view, the lower cortices of this latter type can be misinterpreted as prosoplectenchymatous, which, however, is composed of dense hyphae generally oriented parallel to one another and to the long axis of the lobe. The mixed paraplechtenchyma/hyphal cortex sometimes seen in *P. thomsoniana* may correspond to the 'type 3' cortex described by Moberg (1986), although he considered it to occur largely in species with a usually prosoplectenchymatous lower cortex, whereas here it is a variant in a species with a sometimes paraplectenchymatous lower cortex but never a truly prosoplectenchymatous cortex.

Although the presence of a typical, hyphal medulla can be readily observed in a vast majority of *Physcia thomsoniana* specimens, the tissues in particularly small, thin-lobed specimens must be carefully interpreted. *Physcia thomsoniana* is highly variable in lobe width, and specimens with broader lobes typically also have thicker lobes, within which the various lichen tissues appear normal, that is to say they have a relatively thin upper and lower cortex, an algal layer occupying only the upper third to fourth (or less) of the thallus, and a thick, often dense, medullary layer composed of distinctive hyphae more or less parallel to the long axis of the lobes. However, the narrower lobed thalli (or the narrower lobes of thalli which also have normal wider lobes) tend to be much thinner, often with the algal layer occupying a proportionately larger part of the thallus. In such very thin lobes, the obvious hyphal medulla can be greatly reduced in thickness and the paraplectenchyma of the upper cortex (which often extends between groups of algal cells) may approach the paraplectenchyma of the lower cortex. If careful observation is not made, the reduced hyphal medulla may be overlooked, resulting in interpretation of the thallus as paraplectenchymatous (and leading to misidentification as *P. subtilis*).

Apothecia are not rare in *P. thomsoniana*, and occasional specimens having numerous apothecia and rather sparse blastidia have been misidentified as the fertile species *Physcia halei* J.W. Thomson. However that species is typically more closely appressed, without elevated and entangled lobes, and lacks soredia and blastidia (except occasionally for a few 'pinched' lobe ends). Occasional mixed collections of the two species can be especially confusing. Although Thomson (1963) claimed the entire thallus of *P. halei* was paraplectenchymatous, all the specimens sectioned by me (including the holotype) have a medulla composed of hyphae.

In the western part of its distribution range, *Physcia thomsoniana* can sometimes be confused with *P. tribacia* (Ach.) Nyl. Typical specimens of *P. tribacia*, especially those from the California area (where *P. thomsoniana* has not been found), are usually broader lobed, much more regular in appearance with downturned lobe ends/edges, and bear relatively sparse terminal blastidia. Also, the lower cortex is distinctly paraplectenchymatous, usually without obvious intruding hyphae. However in areas where *P. tribacia* is sympatric with *P. thomsoniana*, which are in more arid regions such as the western Dakotas and

Texas, *P. tribacia* is occasionally smaller and less regular than usual, looking remarkably like *P. thomsoniana*. In one admixture [*Dey 16720A* from Custer Co., South Dakota (NY)], the mixed thalli looked nearly identical, except that the sparse *P. tribacia* had a slightly more tan-gray hue rather than pure gray-white, and longitudinal lobe sections of the two showed the tan-gray thalli to have a more distinctly paraplectenchymatous lower cortex, without obvious hyphal intrusions and with larger lumina (2.5–6.0 vs 2.0–4.0 µm) than the pure gray thalli of *P. thomsoniana.* This color difference is not a consistent character difference between the two species, which exhibit the same overall range in color, but it's notable that where the two grow together, they may express a different color within the range of possibilities. Also, in western North America there occur at least two additional similarly blastidiate species currently under study.

One occasionally encounters herbarium specimens of *Physcia thomsoniana* with broader, more flabellate lobes identified as the similarly granular sorediate corticolous species *P. millegrana* Degel. However that species almost never occurs on rock (after reviewing hundreds of *P. millegrana* specimens, I have never seen a single one from rock), and among other distinctions, that species has an unambiguously prosoplectenchymatous lower cortex.

As seen in the distribution maps, *P. thomsoniana* and *P. subtilis* have similar distributions in eastern North America, although *P. thomsoniana* is more broadly distributed and is more commonly collected. Both species are restricted to North America, although a single apparent specimen of *P. thomsoniana* is also known in a collection from mountains in the state of Puebla in south-central Mexico [*Lehto L21959E* (ASU, herb. Esslinger)].

Additional selected specimens examined. – **CANADA. ONTARIO**: ALGOMA DISTR.: along shores of Lake Superior 8 km W of Pancake Bay Provincial Park on Canada Hwy. 17 ca. 80 km NNW of Sault Ste. Marie, viii.1981, *J.P. Dey 14369* (NY). LEEDS CO.: Landon Bay, 24.viii.1983, *P.Y. Wong 3494* (NY). MANITOULIN DISTR.: Sandfield, Manitoulin Island, 14.ix.1949, *R.F. Cain 6311* (NY). THUNDER BAY DISTR.: Connor Twp., Lot 11 Conc. III, Cookdale, 20.x.1986, *C.E. Garton 23677* (NY). St. Lawrence Islands NationaI Park, Beaurivage Island, 23.viii.1983, *P.Y. Wong 3344* (herb. Esslinger). **QUEBEC.** PONTIAC MUNICIPALITY: Gatineau Park, Farris Creek, 0.1–0.3 mi E of terminus of Chemin de l'Hotel Ville, 0.8 mi E of jct with Quebec 148, 22.v.2011, *J.C. Lendemer 28365* (NY). **U.S.A. ALABAMA**. CLAY CO.: Cheaha State Park, trail to Bald Rock, 24.ix.1992, *R.C. Harris 28287* (NY). JACKSON CO.: Buck's Pocket State Park, along South Sauty Creek, 3.x.1998, *R.C. Harris 42415* (NY). WALKER CO.: Chattahoochee National Forest, Keown Falls, 23.ix.1992, *R.C. Harris 28275* (NY). DEKALB CO.: Little River Canyon tional Preserve, Lynn Overlook, 22.x.2012, *E.A. Tripp 3971* (NY). **ARKANSAS.** STONE CO.: Ozark National Forest, City Rock Bluff Special Interest Area, N of CR53/FSR1105), 2.3 mi W of AR 5, 18.iv.2005, *W.R. Buck 48935* (NY). **CONNECTICUT.** FAIRFIELD CO.: Town of Redding, Highstead Arboretum, W of CT107, just N of The Redding Country Club, 9.vi.2005, *R.C. Harris 51573* (NY). LITCHFIELD CO.: Falls Village, 29.iii.1953, *E. Dahl s.n.* (ASU) TOLLAND CO.: Town of Mansfield, Fifty-Foot Cliff Town Park, from trail behind Mansfield Historical Society Museum, 24.vii.2002, *R.C. Harris 46145* (NY). **GEORGIA**. COFFEE CO.: Broxton Rocks Ecological Preserve, Falling Down Rocks, N of Willow Oak Outcrop, 7.x.1999, *W.R. Buck 36611* (NY). RABUN CO.: Chattahoochee National Forest, Rabun Bald, 20.ix.1996, *R.C. Harris 38917* (NY). WHITE CO.: Cowrock Mountain summit, Appalachian Trail, 12.v.2005, *S.Q. Beeching 3103* (NY). **ILLINOIS.** JACKSON CO.: Giant City State Park near town of Makanda, 12 mi S of Carbondale off US51, ix.1983, *J. P. Dey 14814* (NY), *J.P. Dey 14815* (NY). Johnson Co.: Shawnee National Forest, Simpson Township's Barrens, 16.x.1993, *R.C. Harris 31338* (NY). **IOWA.** BUCHANAN CO.: ca. 7 mi N, 7 mi E of Jesup, Ham's Marsh County Park, 29.iii.2007, *J. Pearson 91* (KANU). EMMET CO.: Estherville, 12.iii.1927, *B.O. Wolden 121* (NY). LYON CO.: ca. 3 mi N, 8 mi E of Larchwood, Gitchie Manitou State Preserve, 24.iii.2004, *M.K. Advaita 3373* (KANU, herb. Esslinger). PLYMOUTH CO.: ca. 4 mi S, 2 mi E of Westfield, Broken Kettle Grassland Preserve, just NE of preserve headquarters & visitor center, 30.iv.2007, *C.A. Morse 15223* (KANU). **KANSAS.** CHEROKEE CO.: 0.25 mi N, 3 mi E Jct of US69 & KS96 at Crestline, Spring River Wildlife Area, 2.iii.2004, *C.A. Morse 10183* (KANU, herb. Esslinger). ELLSWORTH CO.: ca. 1.25 km S of US70 along KS156, 10.ii.2009, *T.L. Esslinger 18805* (herb. Esslinger). GREENWOOD CO.: 4 mi N, 0.5 mi W of Fall River, Fall River State Park, 29.iii.2003, *M K Advaita 3000* (KANU). WOODSON CO.: 6 mi. E of Toronto, Woodson County State Fishing Lake & Wildlife Area, on SE side, 28.ix.2008, *C.A. Morse 18052b* (KANU). **KENTUCKY.** HARLAN CO.: Kentenia State Forest, Profile Rock, 2.7 mi SW of KY2010 on Little Shepherd Trail, along ridge of Pine

Mountain, 16.ix.1991, *W.R. Buck 20805* (NY). **MAINE.** OXFORD CO.: without location, 23.viii.1934, *J.C. Parlin 12416* (NY). WASHINGTON CO.: Town of Steuben, Humboldt Research Institute, yellow trail at "Lover's Leap," 16.vi.2010, *J. Battaglia 2010-166* (NY). **MARYLAND.** BALTIMORE CO.: Harford Road Bridge, on Gunpowder Falls, 18.ix.1909, *C.C. Plitt s.n.* (NY). CECIL CO.: near church, Rock Church Road, off Rt. 273, on Little Elk Creek, 18.xii.1987, *C.F. Reed 126437* (NY). FREDERICK CO.: Catoctin Park, Cunningham Falls, 10.vi.1977, *E.G. Worthley LH-168* (NY). MONTGOMERY CO.: Plummers Island, ca. 10 mi. WNW of Washington. D.C, 23.x.1974, *T.L. Esslinger 4162* (herb. Esslinger). **MASSACHUSSETS.** BERKSHIRE CO.: Town of Florida, Reed Brook Preserve of the Nature Conservancy, S of E end of Whitcomb Hill Rd., 7.v.1995, *R.C. Harris 36556* (NY). NORFOLK CO.: Wellesley, v.1892, *C.E. Cummings s.n.* (NY). **MINNESOTA.** BIG STONE CO.: 3 mi SE of Ortonville, Big Stone National Wildlife Refuge, near old quarry, 24.iv.2011, *M K Advaita 10772B* (KANU), *M.K. Advaita 10775* (KANU). BROWN CO.: ca. 4 mi W, 3 mi S of Dotson, Mound Creek County Park, along Mound Creek, 14.vii.2004, *M.K. Advaita 4221* (KANU, herb. Esslinger). CLEARWATER CO.: Itasca State Park, NW side of Mary Lake, 28.vii.1969, *T.H. Nash III 2204* (ASU). COOK CO.: near the E end of East Bearskin Lake, about 2.6 km along Forest Route 146 from the Gunflint Trail, 28.ix.1991, *T.L. Esslinger 11753* (herb. Esslinger). COTTONWOOD CO.: Red Rocks Falls County Park at Red Rock Dells, 28.ix.1991, *W.R. Buck 20891* (NY). LAC QUI PARLE CO.: 3 mi SE of Ortonville, Big Stone National Wildlife Refuge, near NW Autotour entrance, 28.vii.2009, *M.K. Advaita 8330* (KANU). LAKE CO.: from Palisade head about 45 mi N of Duluth, 6.viii.1950, *O.S. Fearing s.n.* (NY). ROCK CO.: ca. 1.5 mi N, 0.5 mi E of Luverne, Blue Mound State Park, 26.vii.2004, *M.K. Advaita 4262-B* (KANU). PIPESTONE CO.: Pipestone National Monument, just E of ranger station, 6.v.2009, *M.K. Advaita 7109* (KANU). SAINT LOUIS CO.: near the E end of Kabetogama Lake, along the Ash River Trail in the vicinity of the Ash River Campground, ix.1979, *T.L. Esslinger 7736* (herb. Esslinger). YELLOW MEDICINE CO.: ca. 5 mi S, 4 mi E of Granite Falls, Upper Sioux Agency State Park, 4.x.2006, *C.A. Morse 14176b* (KANU). **MISSOURI.** CARTER CO. Peck Ranch Conservation Area, vicinity of Stegal Mountain Fire Tower, ca. 1.8 mi N of Peck Ranch Rd., ca. 3.7 mi E of CRH, 5.3 mi NE of MO 19 at Winona, 16.iv.1997, *R.C. Harris 40423* (NY), *R.C. Harris 40439* (NY). IRON CO.: Pilot Knob National Wildlife Refuge, ca. 1 mi N of Ironton, 30.iii.2006, *J.C. Lendemer 6701* (NY). MADISON CO.: Amidon Memorial Conservation Area, Castor River Shut-Ins Natural Area, off CR235, E of Fredericktown, 21.x.2001, *R.C. Harris 45091* (NY). NEWTON CO.: Wildcat City Park, at S edge of Joplin, Silver Creek Glade, 6.ix.2002, *R.C. Harris 46794* (NY). OZARK CO.: Mark Twain National Forest, along Glade Top Trail, between Bristle Ridge and Sugar Tree Hollow, ca. 3.8 air mi S of Smallett, 11.x.1997, *M.S. Cole 7448* (NY). SAINT FRANCOIS CO.: W of Knob Lick, just W of Knob Lick Fire Tower, 19.ix.1990, *R.C. Harris 25485* (NY). WASHINGTON CO.: Hughes Mountain Conservation Area, E of CR 540, ca. 0.5 mi S of CR-M, ca. 3 mi SW of Irondale, 3.xi.2002, *R.C. Harris 46473* (NY). **NEW HAMPSHIRE.** COOS CO.: White Mountains National Forest, vicinity of Dolly Copp Campground, 19.viii.1986, on bark[!], *T.L. Esslinger 9710* (herb. Esslinger). **NEW JERSEY.** PASSAIC CO.: Wyanokie High Point, 15.iv.1923, *G.P. Anderson s.n.* (NY). SUSSEX CO.: Kittatinny Mountain, W of Harding Lake, *R.H. Torrey s.n.* (NY). WARREN CO.: Delaware Water Gap, E slope, 3.v.1970, *T.H. Nash III 3234* (ASU). **NEW YORK.** BRONX CO.: The New York Botanical Garden, quadrant M-11, 14.ix.2001, *A. Amtoft 352* (NY). CLINTON CO.: Town of Mooers, Gadway Sandstone Pavement Barrens, off Gadway Road, 0.4 mi S of Cannon Corners, 20.x.1996, *W.R. Buck 30891* (NY). DUTCHESS CO.: Nellie Hill Preserve, just NE of Oniontown, just E of Rt. 22, 27.v.2007, *J.C. Lendemer 12056* (NY). GREENE CO.: Catskill Mountains, N end of Mink Hollow and W slope of Sugarloaf Mountain, 6.5 mi N of Shady, Hunter Quad, 7.x.2007, *J.C. Lendemer 9737 = Lichens of Eastern North America Exsiccati #262* (ASU, herb. Esslinger). JEFFERSON CO.: Wellesley Island State Park, Thousand Islands, S of Campground E, 19.ix.1983, *R.C. Harris 16700* (NY). PUTNAM CO.: Town of Putnam Valley, Clarence Fahnestock Memorial State Park, along Appalachian Trail and Old Mine Railroad Trail around Hidden Lake, 21.xi.1998, *W.R. Buck 35263* (NY). ROCKLAND CO.: Bear Mountain State Park, Iona Island Bird Sanctuary, Courtland Island, 18.vii.2010, *J.C. Lendemer 23680* (NY). ULSTER CO.: summit area of Giant Ledge, 10.v.1993, *R.C. Harris 30505* (NY). WARREN CO.: Crane Mountain, 18.ix.1993, *R.C. Harris 30558* (NY). WESTCHESTER CO.: Town of Pound Ridge, Westchester Wilderness Walk, Northern Loop, Zofnass Family Preserve, SW of South Bedford Rd., just W of Mallard Lake Rd., 16.viii.2013, *R.C. Harris 58823* (NY). **NORTH CAROLINA.** AVERY CO.: Grandfather Mountain, ledges below parking platform, vi.1936, *G.P. Anderson s.n.* (NY). BURKE CO.: Linville Falls, 1974, *J.P. Dey 7506* (NY). HAYWOOD CO.: Great Smoky Mountains National Park, Cataloochie Valley Overlook near Bent Knee Knob on Road from Cove Creek Gap, vi.2000, *J.P. Dey 29586* (NY). JACKSON

CO.: vicinity of Whitewater Falls, 27.viii.1971, *T.L. Esslinger 3253* (herb. Esslinger). MITCHELL CO.: about 0.3 mi from Carver's Gap, on way up Roan Mountain, 29.viii.1971, *T.L. Esslinger 3493* (herb. Esslinger). SCOTLAND CO.: Sandhills Game Land, NE shore of Lake Kinney Cameron [Camerons Lake], SW of Monroe Rd./SR 1328, 24.x.2006, *W.R. Buck 51118* (NY). STOKES CO.: Hanging Rock State Park, summit of Hanging Rock, 3.x.1970, *T.L. Esslinger 2671a* (herb. Esslinger). SWAIN CO.: Great Smoky Mountains National Park, trail W of tunnel through Tunnel Ridge at end of Lake View Drive W of Noland Creek, vii.2003, *J.P. Dey 31355* (NY). TRANSYLVANIA CO.: Gorges State Park, SW face of Grassy Ridge, Snake Rock, 9.viii.2005, *J.C. Lendemer 4918* (NY). WILKES CO.: Stone Mountain State Park, ca. 8 mi SSW of Sparta, Cedar Rock and Cedar Rock Trail, 23.ix.1993, *R.C. Harris 30781* (NY). **NORTH DAKOTA.** SLOPE CO.: about 6.5 mi. N and 9 mi. W of Amidon, 1.x.1978, *T.L. Esslinger 6782* (herb. Esslinger). STUTSMAN CO.: ca. 6 mi N, 2 mi W of Pingree, Arrowwood National Wildlife Refuge, 25.vi.2010, *M.K. Advaita 10343-B* (KANU). **OHIO.** SCIOTO CO.: Washington Township, Raven Rock State Nature Preserve, N side of US52, 0.6 mi W of Carey's Run-Pond Creek Rd., just W of Bethel Chapel, 19.v.2006, *W.R. Buck 50252* (NY). **OKLAHOMA.** CHEROKEE CO.: J.T. Nickel Family Nature and Wildlife Preserve (J5 Ranch), ca. 7 mi NE of Tahlequah, Tully Hollow, 30.x.2000, *R.C. Harris 44306* (NY). COMANCHE CO.: ca. 4.25 mi N, 2–2.5 mi W of Cache, Wichita Mountains Wildlife Refuge, 14.iv.2010, *C.A. Morse 20485* (KANU). CREEK CO.: ca. 20 mi WSW of Tulsa, 15 mi W of Sapulpa, along approach road to Heyburn Lake Recreation Area, 12.viii.1979, *T.L. Esslinger 7404* (herb. Esslinger). GREER CO.: 4.5 mi S, 4.5 mi E of Granite, Quartz Mtn Arts & Conference Center and Nature Park, 10.iv.2007, *C.A. Morse 15084* (KANU). JOHNSTON CO.: ca. 3 mi N, 1.5 mi W of Tishomingo, 29.iv.2009, *C.A. Morse 18733* (KANU). MCINTOSH CO.: Lake Eufaula State Park, Longhorn Loop, 20.iv.2013, *S. Strawn 850* (NY). OSAGE CO.: 6 mi W, 2 mi S of Bowring, Osage Wildlife Management Area, 1.i.2003, *M.K. Advaita 1769* (KANU, herb. Esslinger). PUSHMATAHA CO.: 7 mi NW of Clayton, 17.vii.1962, *D. Keck 1608* (NY). **PENNSYLVANIA.** ADAMS CO.: Michaux State Forest, District Rd. 2 mi E of intersection with PA 233, 2.vi.2009, *J.C. Lendemer 18367* (KANU, herb. Esslinger). BRADFORD CO.: N side of Overton Rd./SR3002, ca. 2 mi SW of jct. with US220 in New Albany, 18.v.2009, *J.C. Lendemer 17433* (NY). BUCKS CO.: Ralph Stover State Park, vicinity of High Rocks Vista, E of Tory Rd., Tohickon Creek Gorge, Lumberville Quad, 15.ix.2007, *J.C. Lendemer 9692* (NY). CAMERON CO.: Elk State Forest, Brooks Run Rd. 1.0 mi W of jct w/ PA 872, slopes above Brooks Run, 2.ix.2010, *J.C. Lendemer 24294* (NY). CARBON CO.: Lehigh Gorge State Park, ca. ½ mi S of Drakes Creek Access, E shore of the Lehigh River, 9.xi.2003, *J.C. Lendemer 1513* (NY). CUMBERLAND CO.: Kings Gap State Park, Ritter Tract, E slopes of Irishtown Gap Hollow, ca. 0.3 mi S of Irish Gap Hollow, 2.vi.2012, *J.C. Lendemer 32267* (NY). ELK CO.: Elk State Forest, E shore of Chase Run 0–0.5 mi N of parking area on Trout Run Rd., N of Benezette, 1.ix.2010, *J.C. Lendemer 24242* (NY). FRANKLIN CO.: Michaux State Forest, N-slopes of Rocky Mountain, SW corner of intersection of PA233 & US30, 1.vi.2009, *J.C. Lendemer 18180* (NY). HUNTINGDON CO.: Trough Creek State Park, picnic area along Great Trough Creek, 1 mi N of park office, Todd Township, 22.iv.2008, *R.C. Harris 54248* (NY). LACKAWANNA CO.: Lackawanna State Park, S of Lackawanna Lake, Turkey Hill Trail, slopes above PA407, 2.8 mi N of Waverly, North Abington Township, 17.vii.2008, *J.C. Lendemer 13249* (NY). LANCASTER CO.: E slopes above Susquehanna River, 0.25–0.5 mi N of confluence of Tucquan Creek and Susquehanna River, 8.viii.2009, *J.C. Lendemer 19357* (NY). MONROE CO.: State Game Lands No. 221, 0.15 mi E of Cresco, low S-facing slopes of Seven Pines Mountain, 11.viii.2009, *J.C. Lendemer 19490* (NY). MONTGOMERY CO.: Fulshaw Craeg Preserve, N of Sumneytown, Salford Township, 9.iv.2004, *J.C. Lendemer 2163* (NY). PIKE CO.: Delaware State Forest, Low Knob, 2.5 mi N of Pecks Pond (town), 0.25–1.25 mi E of PA402, Blooming Grove Township, 10.vii.2008, *J.C. Lendemer 12913* (NY). SULLIVAN CO.: Worlds End State Park, along Loyalsock Road, just below boundary of Wyoming State Forest, 28.x.2005, *J.C. Lendemer 5237* (NY). TIOGA CO.: Tioga State Forest, W rim of Pine Creek Gorge, vicinity of Barbour Rock, 13.v.2009, *J.C. Lendemer 16710* (NY). UNION CO.: Bald Eagle State Forest, White Deer Creek Rd. 1 mi S of jct w/ SR1010, W-facing slopes above White Deer Creek, 19.x.2009, *J.C. Lendemer 19821* (NY). WAYNE CO.: Lacawac Sanctuary, ridge E of lodge, above Wallenpaupack Ledges, Paupack Township, 29.vi.2008, *J.C. Lendemer 12156* (NY). WYOMING CO.: Falls Cliffs, 0–1.5 mi S of Falls, E of West Falls, E shore of the Susquehanna River, Falls Township, 19.vii.2008, *J.C. Lendemer 13405* (NY). YORK CO.: W-shore of Susquehanna River, 0.5 mi S of jct. of River Rd. & PA372, ~3.5 mi N of Coal Cabin Beach, 28.v.2009, *J.C. Lendemer 18016* (NY). **RHODE ISLAND.** PROVIDENCE CO.: Town of Lincoln, Lime Rock Nature Preserve, ca. 1 mi SW of Lime Rock, N of Wilbur Rd., 17.ix.2006, *R.C. Harris 53222* (NY). **SOUTH CAROLINA.** GREENVILLE CO.: Bald Rock, along US276 ca. 3 mi N of SC11 toward

Caesars Head, 14.iii.1997, *R.C. Harris 40065* (NY). LANCASTER CO.: Forty Acre Rock Heritage Preserve, just S of Taxahaw, 5.x.1999, *R.C. Harris 43462* (NY). **SOUTH DAKOTA.** CUSTER CO.: Black Hills Nat. Forest, ca. 4 mi S of Mt. Rushmore on Hwy 16A, 15.vii.1977, *T.L. Esslinger 5929* (herb. Esslinger). FALL RIVER CO.: ca. 8.1 mi S of Hot Springs, Whitney Preserve, Alabaugh Canyon, Guest House area, 30.vi.2007, *M.K. Advaita 6368* (KANU). GRANT CO.: ca. 1 mi E of Marvin, Blue Cloud Benedictine Abbey, 22.iii.2007, *M.K. Advaita 5247* (KANU). LINCOLN CO.: ca. 1 mi N, 2.5 mi E of Shindler, Windrows Polo Field, 30.ix.2004, *M.K. Advaita 4653* (KANU). MINNEHAHA CO.: ca. 0.5 mi W, 2 mi S of Garretson, Palisades State Park, 9.vii.2004, *M.K. Advaita 4178* (herb. Esslinger). **TENNESSEE.** CARTER CO.: along abandoned railroad tracks and along Doe River in Doe River Gorge off US19E S of Hampton, viii.1994, *J.P. Dey 25144* (NY). SCOTT CO.: Big South Fork National River and Recreation Area, along North White Oak Creek, 7.viii.1994, *R.C. Harris 32984* (NY). SEVIER CO.: Great Smoky Mountains National Park, ca. 0.5 mi SW of summit of Greenbrier Pinnacle up unmarked/unnamed trail (via Ramsey Cascades Trail), 15.viii.2012, *E.A. Tripp 3662* (NY). **TEXAS.** BURNET CO.: Buchanan Dam, 2.v.1961, *R.A. Darrow 5719* (ASU). JACK CO.: ca. 6.5 mi S, 2 mi E of Bryson 28.iv.2009, *C.A. Morse 18616* (KANU). LLANO CO.: at picnic area along Hwy. 16 just S of the county line, 29.xii.1992, *T.L. Esslinger 12410* (herb. Esslinger). MASON CO.: ca. 5 mi N of jct of Ranch Rd. 386 & US87/377 in Mason, 4.iv.2012, *C.A. Morse 23500a* (KANU). PARKER CO.: ca. 2 mi N, 4.5 mi E of jct of US180W & US281in Mineral Wells, 26.iv.2009, *C.A. Morse 18490b* (KANU). **VERMONT.** ADDISON CO.: Snake Mountain Wildlife Management Area, Snake Mountain, W-facing cliffs S of summit, 19.x.2010, *J.C. Lendemer 27242* (NY). CHITTENDEN CO.: Town of Huntington, Lower Gorge Preserve, W slopes above Huntington River, Huntingdon/Main Rd. ca. 2.25 mi S of jct w/ Dugway Rd., 17.x.2010, *J.C. Lendemer 27084* (NY). ESSEX CO.: Town of Brunswick, West Mountain Wildlife Management Area, Dennis Pond Wetlands, 18.v.2008, *R.C. Harris 54493* (NY). ORLEANS CO.: Town of Westfield, Green Mountains, Hazen's Notch, along VT58/Hazen's Notch Rd., along Long Trail, 13.v.2005, *W.R. Buck 49013* (NY). RUTLAND CO.: Tinmouth, at the base of the E slope of Tinmouth Mountain near the village, 6.ix.1974, *R.S. Egan El-5991* (ASU, herb. Esslinger). (US). **VIRGINIA.** GILES CO.: Mountain Lake Biological Station, 7.x.1995, *R.C. Harris 36713* (NY). GRAYSON CO.: Grayson Highlands State Park, Wilburn Ridge, along Appalachian Trail, 12.ix.1991, *W.R. Buck 20675* (NY). WARREN CO.: Shenandoah National Park, Hogback Mountain overlook, Skyline Drive, 1.v.1992, *J.G. Guccion s.n.* (ASU). WILLIAMSBURG CITY: College of William & Mary, next to Richmond Rd. in front of Monroe Hall, 31.vii.2004, *B.P. Hodkinson 1273* (NY). **WEST VIRGINIA.** GRANT CO.: Shroud Ridge, along Jordan Run Rd./CR28-7 immediately NNE of WV28/55, ca. 2 mi WSW of Cabins, 2.x.2000, *W.R. Buck 38249* (NY). HARDY CO.: 3 mi. SW of Wardensville, 1.viii.1956, *M.E. Hale s.n. = Lichenes Americani Exsiccati #75* (ASU). PENDLETON CO.: Monongahela National Forest, North Fork South Branch Potomac River, Champe Rocks, Vegetation plot MONF.569, 23.vii.2013, *B.P. Streets 4925* (NY). JEFFERSON CO.: Shenandoah River, Vegetation plot JEFF.48, 25.ix.2014, *B.P. Streets 5346* (NY). POCAHONTAS CO.: Watoga State Park, Riverside campground Area, along Jesse's Cove Trail, along Greenbrier River and Rock Run, 30.ix.2000, *R.C. Harris 43972* (NY). **WISCONSIN.** DANE CO.: E of Pine Bluff, 12.vii.1962, *K.G. Foote 62841* (WIS). GREEN CO.: NE of Browntown, 10.vii.1962, *K.G. Foote 62774* (WIS). MARINETTE CO.: S of US 8, 0.1 mi W of South Branch of Peme BonWom River, 24.viii.1975, *W.R. Buck B562* (NY). RICHLAND CO.: 1.5 mi S of Loyd, 14.vii.1974, *M. Nee 12978* (NY). SAUK CO.: N of Leland, 20.viii.1998, *J. W. Thomson s.n.* (WIS).

Physcia subtilis **Degel.,** Arkiv för Botanik 30A(3): 72. 1942. **TYPE: U.S.A. TENNESSEE.** SEVIER CO.: Great Smoky Mountains, above National Park Office, elev. ~700 m, 19.ix.1939, on boulder in deciduous forest, *G. Degelius s.n.* (UPS!, holotype; US!, isotype).

FIGURES 3 AND 4.

DESCRIPTION. – Thallus foliose (microfoliose), somewhat irregular to more or less orbicular, commonly less than 1 cm in diameter although occasionally up to ca. 2 cm. (also sometimes coalescing into apparently significantly larger 'thalli'), usually rather closely appressed to the substrate, although not tightly adnate (lower surface is not adhering to the substrate), therefore removable from the substrate, but only as tiny fragments (no specimens successfully removed from the substrate were seen in this study). Lobes somewhat elongate with broadened ends (flabellate) to linear-elongate and not significantly broadened at the end, (0.08–) 0.1–0.25 mm broad (rarely up to 0.4 mm at flabellate tips or branch points),

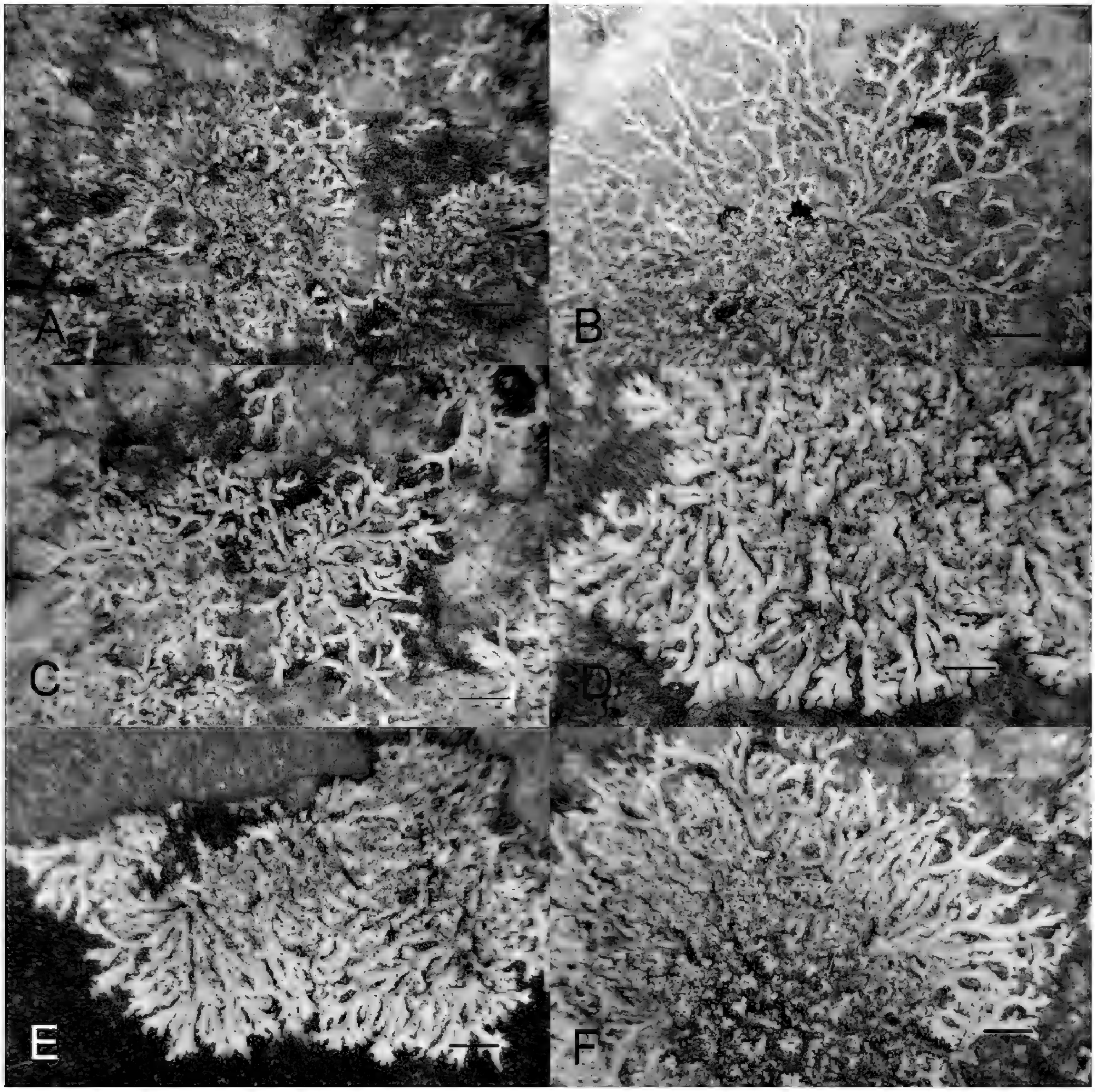

Figure 3, *Physcia subtilis*. **A**. portion of the holotype, *Degelius s.n.*, 19.ix.1939 (UPS) from Tennessee. **B**, *Earle & Batten 180* (NY) from Alabama. **C**, *Lendemer 33112* (NY) from North Carolina. **D**, *Lendemer 23327* (NY) from Tennessee. **E**, *Ladd 23644* (NY) from Kentucky. **F**, *Harris 27255* (NY) from Tennessee. Scales all equal 1 mm.

straight to rather sinuose, irregularly branched, discrete to more contiguous, more or less flat to weakly convex. Upper surface white to gray-white, sometimes darkening to dingy gray, especially near lobe ends (rarely uniformly rather dark gray, but perhaps only in aged herbarium specimens?), not maculate, mostly smooth, usually without pruina. Typical soralia or isidia absent, lobe ends at the periphery sometimes crenate or with sparse single blastidia, inward developing sparse to abundant soredioid granules and/or proliferating blastidia, mostly rather fine, ca. 50–75 (–100) µm. Lower surface white to off-white, flat, sparsely rhizinate, the rhizines short and peg-like (sometimes difficult to observe until lobe sections are made).

Thallus (60–) 70–100 (–125) µm thick, paraplectenchymatous from top to bottom, the lumina mostly 3–6 µm (cell walls 1+ µm thick; intercellular spaces small and inconspicuous), occasionally with a few elongate cells or scattered hyphae in the region of the medulla or algal layer.

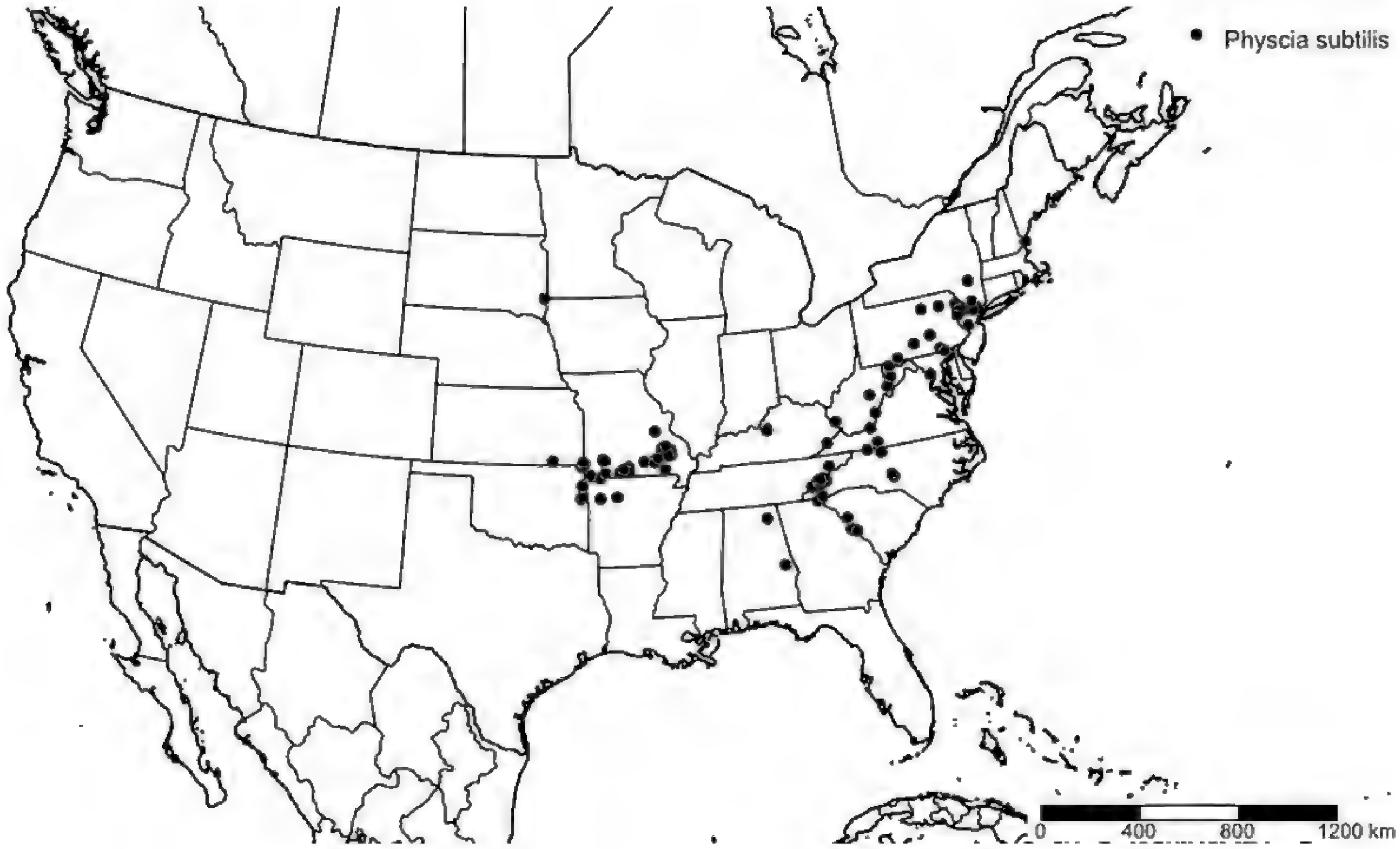

Figure 4. Geographic distribution of *Physcia subtilis* based on specimens examined for this study.

Apothecia frequent, mostly up to ca. 0.4 mm but occasionally up to 0.7 mm in diameter, disk usually flat to weakly convex, black, epruinose, the exciple entire or the larger ones occasionally developing sorediod granules on part or all of it, ascospores (10.5–) 12–15 (–18) × (5–) 6–8 µm, *Physcia*-type although the lumina sometimes become somewhat rounded. Pycnidia occasional, black; conidia bacilliform to very weakly bifusiform, 3–4 x 1 µm.

CHEMISTRY. – Atranorin, presumably only in the upper cortex. Spot tests: upper cortex: K+ yellow, P+ pale yellow, C-, KC-; medulla: (difficult to test because of the thin thallus) K-, P-, C-, KC-.

ECOLOGY. – This species is saxicolous, growing primarily on non-calcareous rock in somewhat shady to more open habitats, and it is very rare on bark (one specimen was seen in this study, on oak bark).

DISCUSSION. – Compared to *Physcia thomsoniana*, the thalli of *P. subtilis* are usually much more clearly appressed to the substrate, although they are not necessarily tightly adnate or adherent. Occasionally a very slightly loose upturned lobe tip will occur, or especially on very rough and uneven rock substrates, a lobe or two will appear to be elevated (i.e., not touching the substrate). In such cases confusion with *P. thomsoniana* is possible and the thallus anatomy must be examined.

The small, typical forms of *Physcia subtilis* usually have a purely paraplectenchymatous thallus structure, from top to bottom. The occasional larger forms with slightly broader and thicker lobes, which may be somewhat flabellate at the ends, occasionally have scattered areas of the medulla and algal layer which have some horizontally elongate cells and/or a few (or a small group of) hyphae.

The smallest and most closely appressed forms of *Physcia subtilis* may be confused with somewhat similar *P. dakotensis*, which is at least partly sympatric with it (Esslinger 2004). However, that species is even more closely appressed and tightly adnate, to the point where usually only the lobe ends can be separated from the substrate intact, and rhizines are often nearly absent, or consist of a few short, inconspicuous pegs. Inward, the lower surface of the thallus in *P. dakotensis* essentially lacks identifiable cortex and rhizines, and it is adnate to the rock substrate. In *P. subtilis*, although the thalli often appear as closely appressed as those of *P. dakotensis*, the lobes, when moistened, can usually be separated from the substrate even far back from the lobe tips. In addition, the two differ in thallus anatomy, with *P. dakotensis* having a medulla composed of hyphae, and a lower cortex either missing or poorly organized and composed of compacted hyphae.

Reports of *Physcia subtilis* from western North America are mostly based on specimens of *P. thomsoniana* (western North Dakota, South Dakota, Texas) or on various unrelated species which can sometimes grow with a similar habit (e.g. extreme forms of *P. dubia* (Hoffm.) Lettau). There also exist at least two undescribed western species with blastidiate lobes, and these are currently under study.

Additional selected specimens examined. – **U.S.A. ALABAMA.** JACKSON CO.: Buck's Pocket State Park, along South Sauty Creek, 3.x.1998, *R.C. Harris 42382* (NY). LEE CO.: Auburn, 12.ii.1897, *F.S. Earle 180* (NY). **ARKANSAS.** CARROLL CO.: 10 mi W of Eureka Springs on US62, 24.iv.1954, *C.L. Kramer 455* (NY). FRANKLIN CO.: Ozark National Forest, Boston Mountain Ranger District, Bee Rock, N of FSR1003, 26 mi W of AR23, 16.iv.2004, *R.C. Harris 49286* (NY). POPE CO.: Ozark National Forest, Kings Bluff, S of AR16, 6 mi E of AR7 at Sand Gap, 7.xi.2002, *R.C. Harris 46858-A* (NY). **GEORGIA.** COLUMBIA CO.: Burks Mountain, ca. 3.5 mi E of US221 from Pollards Corner on road through Rosemont, 12.iii.2010, *J.C. Lendemer 21917* (NY). TOWNS/RABUN CO.: Dick's Creek Gap, ca. 17.1 mi W of Clayton, 11.vi.1981, *R.C. Harris* 13814 (NY). **KANSAS.** CHAUTAUQUA CO.: 3.1 mi. NE of Sedan, 4.iv.1954, *C.L. Kramer 307* (NY). CHEROKEE: jct of US69 & KS96 at Crestline, 4.75 mi S, 2.75 mi E, 28.ix.2005, *C.A. Morse 11817* (KANU). **KENTUCKY.** BULLITT CO.: Bernheim Arboretum and Research Forest, ca. 1 mi NW of Bardstown, slopes above fire tower road, west of loop area, 28.iii.2002, *D. Ladd 23644* (NY). LETCHER CO.: Bad Branch Nature Preserve, ca. 2 mi E of US19 on KY932, below Bad Branch Falls, 14.ix.1991, *R.C. Harris 27060A* (NY). **MARYLAND.** GARRETT CO.: Elk Ridge Native Plant Preserve, between Elk Ridge Lane and Westernport Rd., 21.ix.2013, *J.C. Lendemer 38103* (NY). **MISSOURI.** BARRY CO.: Mark Twain National Forest, Piney Creek Wilderness, N of FSR2185, 4.0 mi E of Hwy. 39, Siloam Spring Trail, 27.iii.2006, *W.R. Buck 49872* (NY). CARTER CO.: Peck Ranch Conservation Area, S end, ca. 5 mi N of Hwy. 60, 25.iv.1991, *D. Ladd 20326* (KANU). DOUGLAS CO.: Rippee Conservation Area, ca. 1 mi N of W end of CR328, 19.v.2003, *R.C. Harris 47353* (NY). FRANKLIN CO.: Meramec State Park, vicinity of Visitor Center, along Natural Wonders Trail, 27.iii.2006, *J.C. Lendemer 5933* (NY). IRON CO.: Pilot Knob National Wildlife Refuge, ca. 1 mi N of Ironton, 30.iii.2006, *R.C. Harris 52432* (NY). LAWRENCE CO.: Fall Hollow Gorge along small tributary of Goose Creek, ca. 0.3 mi W of Hwy O, ca. 0.5 mi N of Hwy 174, Halltown Quad., 27.iii.2006, *J.C. Lendemer 6169* (NY). MADISON CO.: Mark Twain National Forest, Rock Pile Mountain Wilderness, trailhead at end of FSR2124, 1.1 mi SW of CR 406, 2.4 mi NW of MO Hwy C, 14.x.2003, *R.C. Harris 48296* (NY). MCDONALD CO.: Huckleberry Ridge Conservation Area, ca. 3 mi E of Pineville, end of road 1460, 29.x.2000, *R.C. Harris 44216* (NY). OZARK CO.: Caney Mountain Conservation Area, off MO181, Long Bald, 4.viii.1999, *W.R. Buck 36000* (NY). REYNOLDS CO.: Deer Run State Forest, just N of Shannon Co. line, 9.iii.1996, *T. Chadwell 109* (KANU). RIPLEY CO.: Mudpuppy Conservation Area, 0–1 mi NW of MO Hwy BB, ca. 4 mi N of US160, 17.x.2003, *R.C. Harris 48624* (NY). TANEY CO.: Mark Twain National Forest, Hercules Glades Wilderness, Blair Ridge Trail, NNW of FSR155, 2.3 mi SW of MO 125, 2.v.2003, *R.C. Harris 47792* (NY). TEXAS CO.: Gist Ranch Conservation Area, N of Ranch Road, 2.5 mi E of SR137 on Nagle Drive/Ranch Rd., just E of Peters Creek, 4.xi.2004, *R.C. Harris 50276* (NY). WASHINGTON CO.: Mark Twain National Forest, Little Pilot Knob, just N of FSR2265/CR205), 4.6 mi WNW of MO AA, 24.v.2003, *R.C. Harris 47926* (NY). WAYNE CO.: Sam A. Baker State Park, Mudlick Mountain, along road to fire tower, 15.x.2003, *W.R. Buck 45322* (NY). **NEW JERSEY.** PASSAIC CO.: Haskell, 1937, *G.G. Nearing s.n.* (NY). SOMERSET CO.: Neshanic, 20.xi.1942, *G.G. Nearing s.n.* (NY). SUSSEX CO.: Kittatinny Mountain, Appalachian Trail near Walpack Rd., 1932, on oak bark[!], *G.P. Anderson s.n.* (NY). **NEW YORK.** GREENE CO.: Town of Hunter, Catskill Forest Preserve, Stony Clove Notch on W side of NY214, just N of Devil's Tombstone, 13.ix.2008, *R.C. Harris 54840* (NY). ORANGE CO.: Chester, 20.xi.1937, *G.G. Nearing s.n.* (NY). **NEW HAMPSHIRE**. ROCKINGHAM: ca. 1.2 mi S of Odiorne State Park along Hwy lA, 17.viii.1986, *T.L. Esslinger 9634* (herb. Esslinger). **NORTH CAROLINA**. DAVIDSON CO.: High Rock, 7.ix.1936, *P.O. Schallert s.n.* (NY). HAYWOOD CO.: Great Smoky Mountains National Park, rock outcrop along road near Cataloochie Valley Campground area, vi.2000, *J.P. Dey 29594* (NY). MACON CO.: Nantahala National Forest, McDowell Mountain, ca. 10 mi S of Franklin and 2 mi N of Georgia state line on SR1629, 12.viii.1994, *R.C. Harris 33184* (NY). MONTGOMERY CO.: Buck Mountain, 20.iv.1938, *P.O. Schallert s.n.* (NY). SWAIN CO.: Great Smoky Mountains National Park, Straight Fork Rd. between Beech Gap trailhead and Enloe Creek trailhead, 6.viii.2009, *J.C. Lendemer 19175* (NY) **OHIO.** PREBLE CO.: Eaton, 14.iv.1914, *B. Fink 216* (NY). **OKLAHOMA.** ADAIR CO.: just NE of Stilwell City Lake, 1.xi.2000, *R.C. Harris 44504* (NY). DELAWARE CO.: near Flint, about 5 mi E of the junction of OK33 and US59, 12.viii.1979, *T.L.*

Esslinger 7379 (herb. Esslinger). OTTAWA CO.: N of E0060 Rd. on W side of Spring River, just across river from Josephine Smith State Park, 31.x.2000, *R.C. Harris 44445* (NY). **PENNSYLVANIA.** BEDFORD CO.: Cumberland Valley Township, Buchanan State Forest, Pleasant Valley, along Blankley Road, 1.3 mi NE of CR 3011, 18.v.2006, *J.C. Lendemer 7333* (NY). DAUPHIN CO.: property of the city of Harrisburg, below spillway of DeHart Dam, ca. 2 mi E of Carsonville, S of PA325, 10.iii.2007, *J.C. Lendemer 8666* (NY). LANCASTER CO.: Quarry Rd. near Cedar Hill Quarry, 29.i.1989, *C.F. Reed 126932* (NY). LYCOMING CO.: Tiadaghton State Forest, S-facing slopes above Rock Run, along Rock Run Rd. ca. 2 mi E of PA14/town of Ralston, 12.v.2009, *J.C. Lendemer 16607* (NY). PERRY CO.: Big Spring State Park, Rt. 274, N side of road, 4.ix.1998, *R.J. Hill 210* (NY). PIKE CO.: Delaware Water Gap National Recreation Area, Pocono Environmental Education Center, west of access road, 16.ix.2005, *J.C. Lendemer 5002* (NY). WYOMING CO.: Bowmans Creek Ledges, slopes above W-shore of Bowmans Creek, 3.5–4 mi N of Evans Falls, Eaton Township, 20.vii.2008, *J.C. Lendemer 13491* (NY). YORK CO.: State Game Lands No. 83, S shore of Sawmill Run along Sawmill Rd., 0.5–1.5 mi W of York Furnace/confluence of Sawmill Run and Susquehanna River, 9.viii.2009, *J.C. Lendemer 19372* (NY). **SOUTH CAROLINA.** ABBEVILLE CO.: Sumter National Forest, Parsons Mountain, from jct of FSR515 & FSR515B to summit, 17.iii.1997, *W.R. Buck 31727* (NY). AIKEN CO.: Savannah River Bluffs Heritage Preserve, SW of Old Plantation Road, ca. 1 mi SW of I-20 and GA230 intersection, 13.iii.2010, *J.C. Lendemer 22037* (NY, herb. Esslinger). **SOUTH DAKOTA.** LINCOLN CO.: ca. 1 mi N of Shindler, 30.ix.2004, *M.K. Advaita 4643-B* (KANU). **TENNESSEE.** COCKE CO.: Great Smoky Mountains National Park, Appalachian Trail, 0–1.5 mi E of int of Appalachian Trail with spur trail to Mt. Cammerer summit, 18.x.2012, *E.A. Tripp 3938* (NY). GREENE CO.: Greene Mountain, Cherokee National Forest, Green Mountain Rd. 2.3 mi N from CR42, 17.ix.1991, *R.C. Harris 27255* (NY). SEVIER CO.: Great Smoky Mountains National Park, Bullhead Trail, 0–5 mi from parking area on Cherokee Orchard Rd., 9.x.2011, *E.A. Tripp 2159* (NY). **VIRGINIA.** FAIRFAX CO.: Turkey Run Park, N of George Washington Memorial Parkway and bordering Potomac River, 31.x.1971, *J.G. Guccion 1121* (NY). GILES CO.: along Little Stoney Creek, Cascades Recreation Area, ca. 3 mi NE of Pembroke, 23.vi.1978, *R.C. Harris 12888* (NY). GRAYSON CO.: Rt. 626, N of the North Carolina line, 13.vi.1964, *C.F. Reed 68904* (NY). PATRICK CO.: Blue Ridge Parkway, Rock Castle Gorge Loop Trail along Rock Castle Creek at end of Co. Rd. 605, off NC 8, 6.x.1995, *R.C. Harris 36664* (NY). **WEST VIRGINIA.** GRANT CO.: Greenland Gap, Greenland Gap Preserve, Vegetation plot GRGA.9, 22.v.2012, *B.P. Streets 4072* (NY). GREENBRIER CO.: Wades Draft, NE of CR15-2, 0.4 mi SE of WV92, ca. 6 mi. SE of Neola, 1.x.2000, *W.R. Buck 38229* (NY). MINGO CO.: Laurel Lake Wildlife Management Area, Lick Branch, Vegetation plot LALA.7, 11.vii.2010, *B.P. Streets 3635A* (NY). PENDLETON CO.: Monongahela National Forest, Seneca Rocks, Vegetation plot MONF.516, 13.iv.2012, *B.P. Streets 3980* (NY). WEBSTER CO.: Holly River State Park, Vegetation plot HORI.12, 21.vi.2012, *B.P. Streets 4145* (NY).

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Notes on new and interesting lichens from Ontario, Canada - III

CHRISTOPHER J. LEWIS[1] AND SAMUEL R. BRINKER[2]

ABSTRACT. – We report on fifty-seven lichen species from forty-four genera that are new either to Canada or the Province of Ontario, are the first published records in approximately the last century, or are additional provincial records of rare species with few collections. Ranges of several species are also expanded in northeastern North America. The first published reports of *Abrothallus microspermus*, *Lecanora epanora, Parmotrema hypotropum,* and *Placidium arboreum* in Canada are presented, as well as, the first published reports of *Arthrorhaphis alpina*, *Dermatocarpon intestiforme, Menegazzia subsimilis, Multiclavula vernalis, Parmelia neodiscordans, Polychidium muscicola, Porpidia melinodes, Protothelenella corrosa,* and *Ramalina sinensis* in Ontario. We report the first documented records since the late 19th to early 20th century for Ontario of *Arthonia ruana, Heterodermia hypoleuca, Leptogium corticola, Lithothelium septemseptatum, Phaeophyscia hispidula* ssp. *hispidula*, and *Scyntinium dactylinum*. Details on the following additional rare species are also provided: *Acarospora sinopica, Anaptychia palmulata, Arthothelium spectabile, Catapyrenium cinereum, Chrysothrix chlorina, C. xanthina, Evernia prunastri, Gyalecta jenensis*, *Heppia adglutinata, Lecanora fugiens, Lepraria humida, Scytinium subtile, S. teretiusculum, Microcalicium arenarium, Myriospora smaragdula, Normandina pulchella, Opegrapha mougeotii, O. rufescens, Parmeliella triptophylla, Psilolechia lucida, Psora decipiens, P. globifera, P. pseudorussellii, Punctelia appalachensis, Rhizocarpon oederi, Rhizoplaca chrysoleuca, Teloschistes chrysophthalmus*, *Thyrea confusa, Toninia sedifolia*, and *Usnea longissima.*

KEYWORDS. – Rare lichens, Appalachian-Great Lakes, arctic-alpine, metallophytes, range extension, Ontario lichens.

INTRODUCTION

The lichen flora of Ontario has received an increased focus in recent years with several publications documenting new and interesting species (e.g. Brodo et al. 2013, McMullin & Lewis 2013, McMullin et al. 2015). During lichen focused fieldwork over the past several years by professional lichenologists and botanists, several interesting, rare, or otherwise noteworthy lichen species have been discovered. The present contribution to the provincial lichen flora documents these discoveries, and provides discussions on ecology, morphological features useful for identification, and comments on distributions and range extensions. This paper, along with other recent contributions on Ontario lichens, serve as an official documentation of newly discovered/reported species and also highlights our incomplete knowledge of the lichen flora of the province.

MATERIALS AND METHODS

Specimens were identified with a compound or stereo microscope and chemical spot tests using para-phenylenediamine dissolved in ethyl alcohol (PD), sodium hypochlorite (C), 10% potassium hydroxide (K), and Lugol's iodine (I) following methods set out in Brodo et al. (2001). Thin-layer

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chromatography, following Culberson and Kristinsson (1970) and Orange et al. (2001), was performed with solvents A, B and C to detect lichen substances that could not be reliably detected using spot tests. In situ images were captured with either a Canon EOS 7D or Sony Alpha 100 digital SLR camera, mounted with a 100 mm 2.8f macro lens. Image sharpness and size were very slightly augmented for publication with Adobe Photoshop. Range maps were created using ESRI ArcMap 10.1 with digitized specimen data from 64 institutions from the Consortium of North American Lichen Herbaria (CNALH). The CNALH, which aims to digitize lichen label data from lichen collections in North American herbaria, formed in order to provide access to data housed in institutions that would be otherwise difficult to obtain, and we have based our assumptions of species' distributions on records contained in this database. To validate the claims of species being new to their respective regions, specimens were examined at the Canadian Museum of Nature (CANL) and the New York Botanical Garden (NY). Other relevant literature, herbarium materials and herbarium staff were also consulted. All specimens are deposited as indicated in CANL, NY, or the herbarium of the Władysław Szafer Institute of Botany (KRAM).

RESULTS: NEW AND INTERESTING REPORTS

The reports presented below are arranged alphabetically by genus and species. Names preceded by an asterisk (*) are new for Ontario and names preceded by two asterisks (**) are new to Canada. Those preceded with a dagger (†) are the first reports since the late 19th or early 20th century. Nomenclature follows Esslinger (2016). Taxonomic authorities follow Brummitt and Powell (1996).

*****Abrothallus microspermus* Tul.**

NOTES. – This is the first confirmed report of *Abrothallus microspermus* from Canada. It was found growing on a *Punctelia* species.

Specimen examined. – **CANADA. ONTARIO.** KENORA DIST.: Lake of the Woods, Cliff Island, dry oak savannah on south-facing slope, 10.vi.2013, on *Punctelia caseana* Lendemer & Hodkinson, *C.J. Lewis 1545a* (NY; det. J.C. Lendemer).

***Acarospora sinopica* (Wahlenb.) Körb.**

NOTES. – A recent record of *Acarospora sinopica* was published for southern Ontario by McMullin et al. (2015). Reported here are several additional records that extend its range in the province north to the Thunder Bay District. *Acarospora sinopica* is a metallophyte, or heavy metal-loving species restricted to naturally exposed rock or old mine slag piles high in certain heavy metals, especially iron or copper (Fletcher et al. 2009a). Its distinctive rusty-red to orange "oxydated" colour is likely at least in part due to the oxidation of pyrite, an iron sulfide material found in the substrate that becomes hydrated iron oxide in the lichen thallus, though this requires further study (Purvis 2014). It has a cosmopolitan distribution, and is known from Europe, Asia, Australia, North America, and Africa (Kerr & Zavada 1989, Rajakaruna et al. 2011). It is typically found in association with other metallophytes (e.g. *Myriospora smargdula* (Wahlenb. ex Ach.) Nägeli ex Uloth, *Rhizocarpon oederi* (Weber) Körb., *Diploschistes scruposus* (Schreber) Norman) and James et al. (1977) referred to this distinctive lichen community in Britain as the *Acarosporion sinopicae*. We have found it to co-occur in Ontario with the metallophytes *Porpidia melinodes* (Korber) Gowan & Ahti, *R. oederi*, *M. smaragdula*, and *Lecanora epanora* (Ach.) Ach.

Specimens examined. – **CANADA. ONTARIO.** HASTINGS CO.: E of Tommy Lake, dry, W-facing exposed rock outcrop with lateral secretions of iron and sulphur precipitate, 27.iii.2013, on rock, *S.R. Brinker 2814* (CANL). RENFREW CO.: 12 miles SW of Calabogie, cliff E of hydro dam on the N side of the Madawaska River, mixed marble, sandstone and granite, 16.ii.1974, on rock, *I.M. Brodo 20279* (CANL). TEMISKAMING DIST.: South Lorrain Township, approximately 19.5 km E of Temagami and 82 km N of North Bay, waste pile of metal rich rocks beside an old mine in the Cooper Lake/McDonald Creek area, 28.ix.2010, on rock, *C.J. Lewis 496* (NY). THUNDER BAY DIST.: Cavern Lake Provincial Nature Reserve, 57 km NE of Thunder Bay, steep-sided canyon with talus slopes, 21.viii.2016, on exposed boulders, *S.R. Brinker 5161* (CANL); Little Pigeon Bay Rd., 45 km SW of Thunder Bay, shaded rock face near entrance to old mine shaft, 18.vii.2016, on exposed near-vertical rock, *S.R. Brinker 5096* (CANL).

Anaptychia palmulata (Michx.) Vain.

FIGURE 1A

NOTES. – This species was listed by Wong and Brodo (1992) as infrequent in southern Ontario (then known from five counties), though several of their reports were historical and from counties (e.g. Peel and Northumberland) that have seen major declines in forest cover since the pre-settlement era (Larson et al. 1999). We assert these populations are likely extirpated as they have not been relocated in modern times. Other authors of historical and present-day lichen floras in the Great Lakes region have reported *Anaptychia palmulata* as one of numerous sensitive species lost due to the combined effects of air pollution and habitat loss (e.g. Wetmore 1989, Nelson et al. 2007). It was also reported as uncommon and potentially declining in New England (Hinds & Hinds 2007). *Anaptychia palmulata* is typically corticolous, found on maples (*Acer* spp.) and ash (*Fraxinus* spp.) in the southern portion of the province, and on cedar (*Thuja occidentalis*) further north. Wong and Brodo (1990) also reported it as occurring on crystalline rock in especially humid situations. *Anaptychia palmulata* is endemic to eastern North America and eastern Asia (Esslinger 2007).

Specimens examined. – **CANADA. ONTARIO.** GREY CO.: Kinghurst Forest Reserve, NE of Hanover, mature *Acer-Fagus* forest, 200-300 years old, 14.iv.2012, on large *Acer saccharum* trunk, *C.J. Lewis 1023* (OAC), *C.J. Lewis 1024* (CANL), *C.J. Lewis 1025* (NY). FRONTENAC CO.: Salmon River, N of the Hamlet of Ardendale, adjacent to Hwy 7, 09.iii.2011, on shaded NE-facing cliff adjacent to low-lying area, *C.J. Lewis 520* (CANL); Forestry Access Road (extension of Arcol and Dam top Road), North Canonto Twp., W of Norcan Lake, mixed hardwood forest, on forested slope with N-facing aspect, 3.iii.2012, on large *A. saccharum* trunk, *C.J. Lewis 982* (CANL); Frontenac Provincial Park, Tetsmine Trail, shaded humid valley in mature deciduous forest, 1.x.2016, growing on *Fraxinus* trunk, *C.J. Lewis 2666* (CANL); Slide Lake Trail, exposed calcareous boulders at the base of a cliff, along the lake shore, 20.ii.2017, on boulders, *C.J. Lewis 2778* (CANL). HASTINGS CO.: 3.5 km W of Wilberforce, between Little Esson Lake and Esson Lake, mixed lowland swamp with *Thuja occidentalis* and *Fraxinus nigra*, 22.ii.2013, on *F. nigra* and *T. occidentalis*, *S.R. Brinker 2808* (CANL). PARRY SOUND DIST.: Mikisew Provincial Park, 11.3 km W of South River, mature *Acer-Fagus-Tsuga* deciduous forest on E-facing slope, 21.vi.2015, on old-growth *A. saccharum*, *S.R. Brinker 4480* (CANL). THUNDER BAY DIST.: S end of Ouimet Canyon, 60 km NE of Thunder Bay, in *T. occidentalis*-dominated coniferous forest on steep rocky slope with *Acer spicatum*, 04.viii.2015, on *T. occidentalis*, *S.R. Brinker 4663* (CANL); Albert Lake Mesa, 53 km E of Nipigon, 23 km SW of Black Sturgeon Lake, in old-growth conifer swamp with *T. occidentalis*, *Abies balsamea*, *Taxus canadensis* and *Acer spicatum*, 16.vii.2016, on bark of *T. occidentalis*, *S.R. Brinker 5071* (CANL). NIPPISING DIST.: Petawawa Forest Experiment Station, Chalk River, road off Lapasse - Foresters Falls, Precambrian shield bedrock with calcareous soil, 23.iv.1973, on boulder of crystalline limestone with hepatic, *R. Moore 6057* (CANL); Algonquin Provincial Park, Barron Canyon, base of a moist shaded rock cliff, 6.v.2010, on rock subject to nutrient leaching, *C.J. Lewis 400* (CANL). ALGOMA DIST.: Lake Superior Provincial Park, Crescent Lake Campground, Hwy 17, S end of the Park in maple forest, 12.vii.1993, on bark, *S. Sharnoff & S. Sharnoff 1110.36* (CANL). PEEL CO.: Edmonton, 1.iv.1893, on *Fagus* trees, *J. White 316* (CANL). HALIBURTON CO.: Fletcher Lake, 50 m NW of Poorhouse Lake, in mature hardwood forest in shade, 4.v.2009, on mossy *Acer* sp. trunk, *C.J. Lewis 311* (CANL). LANARK CO.: Hwy 511, 20 km S of Calabogie, mixed mature deciduous forest with ridges, 8.iv.2016, on mossy calcareous boulder, *C.J. Lewis 2296* (CANL). PETERBOROUGH CO.: 1.5 km W of Vansickle, 5 km E of Oak Lake, conifer swamp with *T. occidentalis*, *P. glauca*, *F. nigra*, and *Betula alleghaniensis*, 29.iv.2016, on *T. occidentalis*, *S.R. Brinker 4829* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, portage between Plough Lake and Ottertrack Lake, 1 km N of Knife Lake, in mature conifer swamp with *T. occidentalis*, *A. balsamea* and *Picea mariana*, 18.viii.2016, on *T. occidentalis*, *S.R. Brinker 5253* (CANL).

†*Arthonia ruana* A. Massal.

NOTES. – An inconspicuous species found growing in rich forests on tree bark (Coppins and Aptroot 2009). This is the first modern report for the province, although there are historic records collected by John Macoun around the turn of the last century (Wong & Brodo 1992).

Specimen examined. – **CANADA. ONTARIO.** LANARAK CO.: 22 km S of Calabogie, Hwy 511 off of the French Line, mixed deciduous forest with low-lying areas and high ridges, 10.xii.2015, on *Fraxinus* spp. *C.J. Lewis 2268* (CANL).

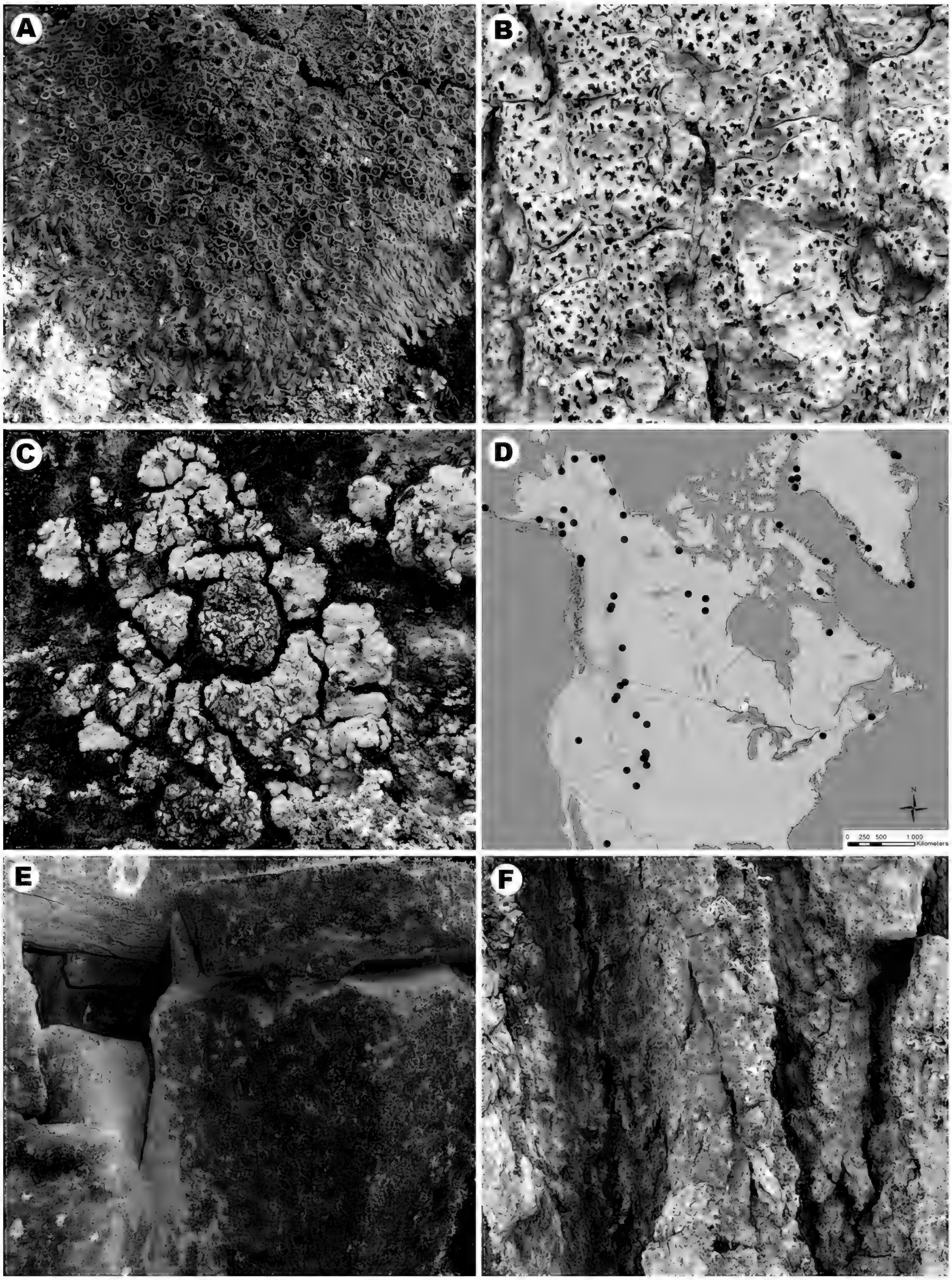

Figure 1. Photographs of species and distribution maps (white = new Ontario records, black = previous collections). **A,** *Anaptychia palmulata* habit, on rock, Frontenac County. **B,** Detail of *Arthothelium spectabile* on *Fraxinus nigra,* Peterborough County. **C,** *Arthrorhaphis alpina,* on siliceous rock, Thunder Bay District. **D,** distribution of *Arthrorhaphis alpina* in North America. **E,** *Chrysothrix chlorina,* on sheltered north-facing cliff, Kenora District. **F,** Detail of *Chrysothrix xanthina* on bark of *Quercus macrocarpa,* Peterborough County.

Arthothelium spectabile **A. Massal.**

FIGURE 1B

NOTES. – These are the first reported collections from Ontario since Roy Cain collected the species in York County in 1960 (Wong & Brodo 1992). Prior to this, earlier collections were made by John Macoun in eastern Ontario over a century ago (Wong & Brodo 1992). *Arthothelium spectabile* is a widespread temperate to suboceanic species typically reported on trees with smooth bark (Grube & Giralt 1996). It has reportedly declined elsewhere; for example, it is presumed extinct in the British Isles, not having been observed since the 19th century (Coppins 2009).

Specimens examined. – **CANADA. ONTARIO.** GREY CO.: Kinghurst Forest Reserve NE of Hanover, mature *Acer-Fagus* forest 200-300 years old, 14.iv.2012, on large *Acer saccharum* trunk, *C.J. Lewis 1029* (CANL). FRONTENAC CO.: Frontenac Provincial Park, 18 km N of Sydenham, S of Clearwater Lake, shaded gorge with local marble outcrops in rich deciduous forest, 03.vii.2012, on *Acer saccharum*, *S.R. Brinker 2512* (CANL). PETERBOROUGH CO.: N of Chandos Lake, *Acer-Tsuga* mixed forest, 1.xi.2012, on *Fraxinus nigra*, *C.J. Lewis 1424 & S.R. Brinker* (CANL).

******Arthrorhaphis alpina*** **(Schaerer) R. Sant.**

FIGURE 1C

NOTES. – *Arthrorhaphis alpina* is an addition to the lichen flora of the province. *Arthrorhaphis alpina* is a widespread, circumpolar arctic-alpine species that usually grows on moist soil and over humus (Thomson 1997); in Greenland it is sometimes associated with late snow patches (Hansen & Obermayer 1999). Our records are from rock in canyons with associated glaciere talus, a rare vegetation community that forms below large cliffs mainly as the result of periglacial frost and ice-wedging (Bakowsky 1997), and in Ontario are noted for their concentrations of arctic-alpine plants (e.g. Given & Soper 1981). The occurrence of *A. alpina* in the Great Lakes Basin is remarkable, being disjunct from its mainly western-montane and arctic distribution by over 1500 km (Figure 1D).

Specimens examined. – **CANADA. ONTARIO.** THUNDER BAY DIST.: Ouimet Canyon, 60 km NE of Thunder Bay, 4.iix.2015, on exposed siliceous boulders in sheltered canyon with localized pockets of persistent ice, *S.R. Brinker 4682* (CANL); Cavern Lake Canyon, 57 km NE of Thunder Bay, 21.vii.2016, on exposed siliceous boulders at base of talus near cool air vents with localized pockets of persistent ice, *S.R. Brinker et al. 5148* (CANL).

Catapyrenium cinereum **(Pers.) Körb.**

NOTES. – These new discoveries from two southern Ontario counties represent the only collections of *Catapyrenium cinerum* since it was reported new to the province by Brodo et al. (2013). Ontario collections are from alvars with exposed limestone pavement and areas with exposed, stable calcareous sand. Elsewhere in North America, *C. cinereum* is a component of biological soil crust communities in arid regions and arctic and alpine habitats, ranging south to California (Thomson 1987).

Specimens examined. – **CANADA. ONTARIO.** GREY CO.: Allan Park Saugeen Valley Conservation Area lands E of Hanover, 17.iv.2006, on sandy calcareous soil on a south facing slope, *C.J. Lewis AP2* (CANL; conf. I.M. Brodo), 14.iv.2012, on sandy soil, *C.J. Lewis 1019* (NY). MANITOULIN DIST.: Manitoulin Island, 1 km inland of Lake Huron between Portage Bay and Murphy Harbour, 2 km SW of Lorne Lake, open *Pinus banksiana - Thuja occidentalis* alvar woodland, 2.vi.2014, among bryophyte cover over limestone pavement, *S.R. Brinker 3410* (NY; conf. J.C. Lendemer).

Chrysothrix chlorina **(Ach.) J.R. Laundon**

FIGURE 1E

NOTES. – Of all species of *Chrysothrix* in North America, *C. chlorina* seems to have a markedly northern distribution in the eastern portion of the continent, with published records north to Ombabika Bay in Lake Nipigon, Ontario (Harris & Ladd 2008). Our additional records demonstrate it is locally common in the Thunder Bay District where cliff and talus slopes occur, and extend its range in the northeast over 500 km north of Lake Nipigon at the Sutton Gorge. *Chrysothrix chlorina* is saxicolous and requires protected microhabitats among non-calcareous talus and cliff habitats (Figure 1E) that offer moderate to high light, humidity, and limited exposure to direct wetting.

Specimens examined. – **CANADA. ONTARIO.** KENORA DIST.: 47 km SE of Sandy Lake airport, ca. 4 km SSE of McKendry Lake, near Roseberry River, N-facing cliff face and adjoining upper talus slope, 7.vii.2011, on rock, *S.R. Brinker 2167* (CANL, NY); Sutton Gorge, 101 km SE of Peawanuck,

between Hawley Lake and Sutton Lake, cryptogram-dominated talus at base of W facing cliff in crevices, 6.viii.2014, on siliceous rock, *S.R. Brinker 4139* (NY). THUNDER BAY DIST.: The Pinnacles NW of Dorion, E of Innes Lake, base of shaded cliff face on talus slope, 20.vii.2014, on shaded boulders, *S.R. Brinker 4069* (NY); Ouimet Canyon, 9.5 km W of Dorion, extensive talus and boulder field in deep canyon, 20.vii.2014, on sheltered siliceous boulders, *S.R. Brinker 4081* (NY); Sleeping Giant Provincial Park, trail to Talus Lake, sheltered talus at base of large cliff, 21.vii.2014, on rock, *S.R. Brinker 4104* (NY); Michipicoten Island Provincial Park, S shore of Channel Lake, roughly 400 metres W of trailhead from Quebec Harbour, NE facing cliff with scattered canopy of *Thuja occidentalis* and *Abies balsamea*, 29.vii.2015, on rock, *S.R. Brinker 4596* (NY); Kama Hills Conservation Reserve, 19 km E of Nipigon, among sheltered boulders below large cliff, 2.viii.2015, on rock, *S.R. Brinker 4651* (CANL); Lake Nipigon, Hat Mountain Island, at base of N-facing cliff among boulders on talus slope, 13.vii.2016, on rock, *S.R. Brinker 4972* (CANL); Lake Nipigon, Orient Bay, 47 km N of Nipigon, exposed talus below cliff, 15.vii.2016, on volcanic (diabase) rock, *S.R. Brinker 5038* (CANL).

Chrysothrix xanthina **(Vainio) Kalb**

FIGURE 1F

NOTES. – Only one previously confirmed record of this species exists for Ontario from Algonquin Provincial Park (Lewis et al. in prep). Harris and Ladd (2008) provided a northeastern North American map showing it is widely distributed from Florida north to Michigan and Minnesota. Our records extend its northeastern distribution into Ontario as far north as Lake of the Woods near the Manitoba border (Figure 2A). The similar *Chrysothrix candelaris* is not known from eastern North America and has coarser granules (35–80 µm in diameter vs. 15–45 µm in diameter for *C. xanthina fide* Harris & Ladd 2008). As with *C. chlorina*, we observed *C. xanthina* in areas that are well lit and protected from direct wetting. *Chrysothrix xanthina* however, is largely corticolous (Harris & Ladd 2008), and our collections are all from the bark of mature deciduous or coniferous trees in humid areas close to bodies of water.

Specimens examined. – **CANADA. ONTARIO.** PETERBOROUGH CO.: N of Chandos Lake, creek valley in mature lowland forest, 19.xi.2012, on *Acer* sp. trunk, *C.J. Lewis 1425* (CANL) with S.R. Brinker; Stewart's Woods, 3 km E of Fraserville along Otonabee River, mature floodplain deciduous swamp with *Fraxinus pennsylvanica* and *Acer* ×*freemanii,* 1.ii.2016, on bark of *Quercus macrocarpa*, *S.R. Brinker 4790* (NY). KENORA DIST.: S side of Copper Island, Ptarmigan Bay, Lake of the Woods, in low-lying mixed-conifer swamp, 11.vi.2013, on lower boles of *Picea glauca*, *S.R. Brinker 2929 & C.J. Lewis* (NY). PRINCE EDWARD CO.: Main Duck Island, Lake Ontario, in humid deciduous woods, 24.ix.2013, on lower bole of large *Quercus rubra*, *S.R. Brinker 3246* (NY). THUNDER BAY DIST.: Gardner Lake Trail, Sleeping Giant Provincial Park, in mature mixed forest with *P. glauca*, *Pinus strobus* and *Abies balsamea*, 21.vii.2014, on bark of large *Betula papyrifera*, *S.R. Brinker 4098* (NY). FRONTENAC CO.: Lemoine Point Conservation Area, E of Kingston, 500 m from the Lake Ontario shoreline, 31.x.2015, on large trunk of *Carya ovata* in a forest opening, *C.J. Lewis 2186* (CANL) with Roxy. ALGOMA DIST.: Lake Superior Provincial Park along the Sand River, 61 km S of Wawa, in mixed forest on N-facing slope with *A.balsamea*, *Betula alleghaniensis*, *Acer spicatum*, and *Thuja occidentalis*, 11.vii.2016, rare on bark of old *B. alleghaniensis*, *S.R. Brinker 4950* (CANL).

Dermatocarpon intestiforme **(Körb.) Hasse**

NOTES. – These specimens match well with descriptions of this variable species (multiple-lobed with multiple holdfasts giving it a contorted intestine-like center) (Goward et al. 1994). *Dermatocarpon intestiforme* is a mainly western taxon in North America, found on calcareous rock-faces in dry to semi-arid regions, often along lake shores and the upper parts of the inundated zones of rivers (Thomson 1984). Our records are from exposed calcareous rocky areas above inundation zones of several lakes in northwestern Ontario and the north shore of Lake Superior (Figure 2B).

Specimens examined. – **CANADA. ONTARIO.** KENORA DIST.: Lake of the Woods, Shoal Point, dry rock cliff by lake edge, S facing, 11.vi.2013, on rock, *C.J. Lewis 1599* (CANL); THUNDER BAY DIST.: S side of Cape Island, part of the Leadman Island group, Lake Superior, exposed rocky shore near splash zone, 17.vii.2014, on rock, *S.R. Brinker 4019* (CANL); Green Island, E side, Lake Superior, off south side of Michipicoten Island, exposed siliceous rock along shoreline, 28.vii.2015, in crevices of bedrock, *S.R. Brinker 4565* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, NE end of Emerald Lake, N-facing cliff above high water mark, 19.viii.2016, on exposed ledges of metamorphic (greenstone) rock, *S.R. Brinker 5269 & P. Scott* (CANL).

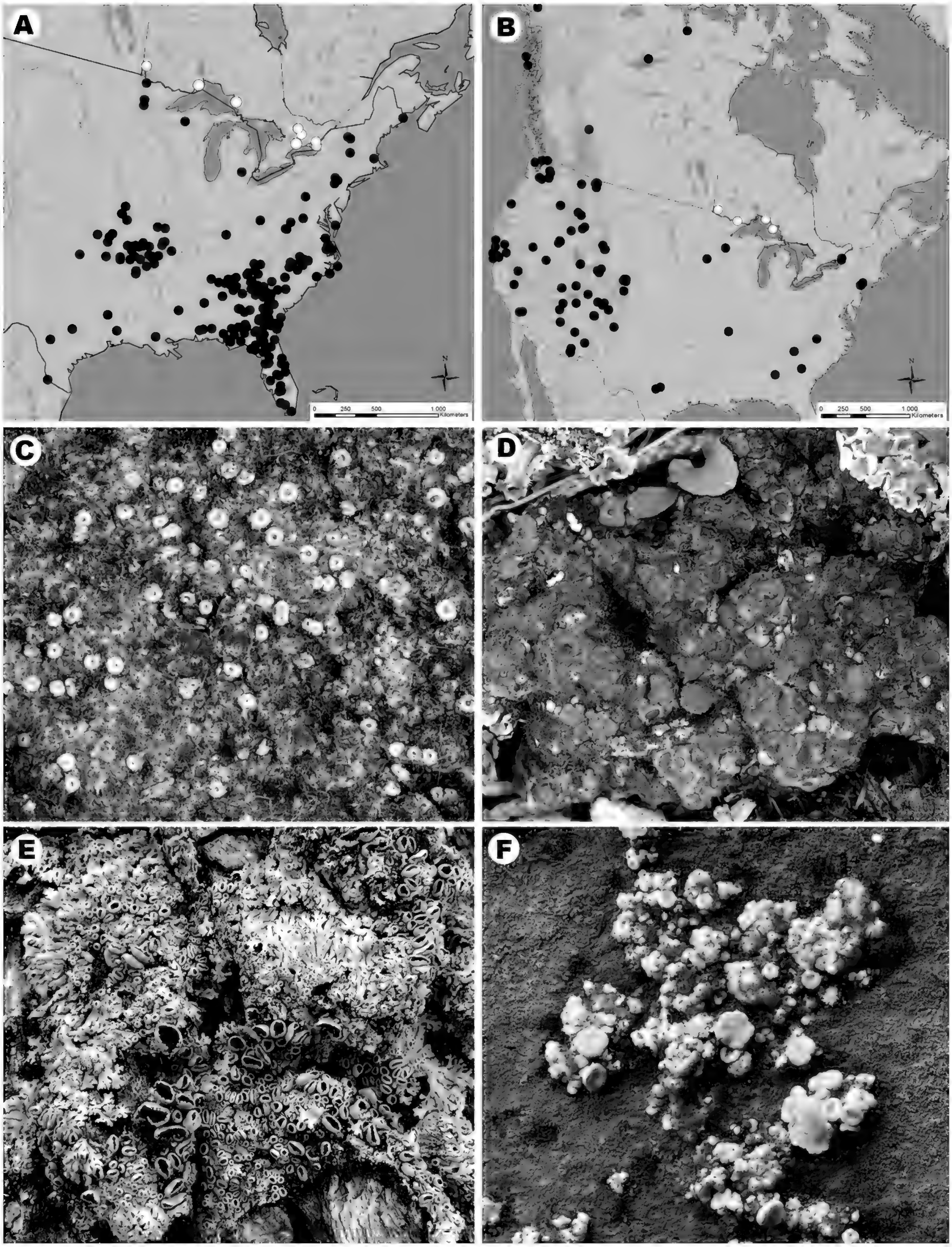

Figure 2. Photographs of species and distribution maps (white = new Ontario records, black = previous collections). **A,** distribution of *Chrysothrix xanthina* in North America. **B,** distribution of *Dermatocarpon intestiforme* in North America. **C,** Detail of *Gyalecta jenensis*, Frontenac County. **D,** Detail of *Heppia adglutinata* on shallow soil over limestone, Prince Edward County. **E,** *Heterodermia hypoleuca* habit, on *Fraxinus pennsylvanica,* Renfrew County. **F,** *Lecanora epanora,* on shaded rock, Thunder Bay District.

***Evernia prunastri* (L.) Ach.**

NOTES. – Macoun (1902) first reported *Evernia prunastri* as quite common in Ontario on old fence rails, trees, and old pine stumps. Until recently however, it was thought to have been extirpated from the province given the lack of contemporary records. It was recently discovered at two new locations on the upper Bruce Peninsula on Georgian Bay (Brodo et al. 2013), and more recently in Wellington County at the University of Guelph Arboretum (McMullin et al. 2014). It was also recently reported by McMullin (2015b) from the Slough of Despond, a large swamp in Bruce County. The following record represents only the fourth published report for *E. prunastri* for Ontario in the last 100 years, and extends its Great Lakes range to the southern portion of the province on Lake Erie. Elsewhere, *E. prunastri* has started to recolonize semi-natural sites in Central Europe following pollution abatement measures (Guttová et al. 2011). The number of recent records here suggests this species is responding to improvements in air quality or climatic amelioration since it is very sensitive to eutrophication and sulphur dioxide levels, and is widely used as a bioindicator of air quality (Lackovičová et al. 2013).

Specimen examined. – **CANADA. ONTARIO.** ELGIN CO.: Rondeau Provincial Park, just N of Gardiner Ave., 5.5 km NE of Erie, deciduous swamp with *Fraxinus pennsylvanica* and *Acer saccharinum*, 10.vi.2015, on dead *F. pennsylvanica* recently succumbed to the invasive Emerald Ash Borer beetle, *S.R. Brinker 4472* (CANL).

***Gyalecta jenensis* (Batsch) Zahlbr.**

FIGURE 2C

NOTES. – Published reports of *Gyalecta jenensis* in Ontario are from cedar-dominated conifer forests with Silurian dolomite outcrops near Georgian Bay at Bruce Peninsula National Park and Flowerpot Island in Fathom Five National Marine Park (Brodo et al. 2013). It is a boreal and temperate saxicolous species restricted to moist, humid, sheltered calcareous rock, sometimes spreading to adjacent humus (Thomson 1997, Ryan and Nimis 2004). It is likely overlooked and more common than current records indicate. Our records expand its range in the province west to the Rainy River District.

Specimens examined. – **CANADA. ONTARIO.** BRUCE CO.: Bruce Caves Conservation Area, on moist dolomite cliff face in mixed forest, 16.iii.2016, on limestone, *C.J. Lewis et al. 2284* (CANL). THUNDER BAY DIST.: N shore of Mortimer Island, between Barnard Point and Copper Harbour, on sheltered medicolous rock face in small protected inlet along Lake Superior coast, 15.vii.2014, on rock, *S.R. Brinker 3933* (CANL). ALGOMA DIST.: Deadman's Cove, SE shore of Lake Superior, 60 km NW of Sault Ste. Marie, shaded vertical rock face under conifers, 11.vii.2016, on moist igneous (basalt) rock, *S.R. Brinker 4939* (CANL). TEMISKAMING DIST.: Kap-Kig-Iwan Provincial Park, Englehart River, S of Englehart, rock face adjacent to falls along river, 8.vii.2012, on moist rock, *C.J. Lewis 1202* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, NE end of Emerald Lake, 75 km SE of Atikokan, moist shaded crevice of N-facing cliff, 19.viii.2016, on vertical metamorphic (greenstone) rock, *S.R. Brinker 5291 & P. Scott* (CANL).

***Heppia adglutinata* (Kremp.) A. Massal.**

FIGURE 2D

NOTES. – These records add to the overall distribution of *Heppia adglutinata* in Ontario since it was first reported from the Bruce Peninsula (Brodo et al. 2013). This species was long known as *H. lutosa* (Ach.) Nyl., but Henssen (1994) restricted the concept of that that species mainly to material from the central and southwestern United States. It has an I+ deep blue ascus with a translucent green thallus, while *H. adglutinata* is I- with a yellow-olive or brownish thallus (Henssen 1994). *Heppia adglutinata* is a cyanolichen often found as a component of biological soil crusts on carbonate soils that occur over limestone, marble, and other calcareous rock (Belnap & Lange 2003). In Ontario, it is a rare species only known from globally rare alvars of the Smith Falls Plain (Lower Ordovician, Ottawa Formation), Prince Edward Peninsula (Lower Ordovician, Lindsay Formation), and Bruce Peninsula (Lower Ordovician, Guelph Formation).

Specimens examined. – **CANADA. ONTARIO.** LENNOX AND ADDINGTON CO.: N of Napanee, Fred Brown Rd., open alvar pavement with shallow soil, 20.ix.2016, on soil, *C.J. Lewis 2611* (CANL); Roblin Municipal Dump Alvar, 1.5 km SW of Roblin on Roblin Rd., small bryophyte-dominated open alvar surrounded by mixed conifer woods, 20.ix.2016, growing on calcareous soil. *C.J. Lewis 2604* (CANL). PRINCE EDWARD CO.: Massassauga Point, Bay of Quinte, in *Juniperus virginiana* treed alvar on limestone pavement, 7.iv.2013, on soil, *S.R. Brinker 2837* (CANL), *S.R. Brinker* 4732 (NY; conf. J.C.

Lendemer). OTTAWA-CARLTON CO.: Claybank Alvar, in shallow soil over limestone pavement in disturbed alvar near edge of mixed *Thuja* woods, 16.x.2015, on soil, *S.R. Brinker 4754* (CANL); Panmure Alvar, Timmins Road, *J. virginiana* treed alvar on exposed, shallow-soiled limestone bedrock, 5.x.2015, growing on soil, *C.J. Lewis 2235* (CANL).

†*Heterodermia hypoleuca* (Ach.) Trevis.

FIGURE 2E

NOTES. – These new Ontario records are the first in over a century from the province (Wong & Brodo 1992). The two previous known collections were made by Braddish Billings Jr. and John Macoun from Prescott and Brighton, both on Lake Ontario, in 1861 and 1893, respectively (*Billings s.n.,* CANL; *Macoun 178,* CANL). An unpublished collection from Lanark County by Rob Lee (933, *REL*) is also known to exist. Due to the paucity of contemporary records, this species was considered extirpated from Ontario and Canada (Goward et al. 1998); these new records reconfirm its continued existence. The loss of remaining old-growth forests in southern Ontario (Larson et al. 1999), which provided unique humid interior microclimates, has undoubtedly resulted in the loss of a large portion of suitable habitat. *Heterodermia hypoleuca* was listed as a species in decline in New England states by Hinds and Hinds (2007). The ecorticate lower surface, esorediate thallus, discrete lobes with small adventive lobes and lobulate apothecia distinguish the species from other species of *Heterodermia* in eastern North America (Lendemer 2009).

Specimens examined. – **CANADA. ONTARIO.** FRONTENAC CO.: Frontenac Provincial Park, Tetsmine Trail, NW portion of the park, old growth deciduous forested valley, 24.ix.2016, on *Fraxinus* sp. trunk, *C.J. Lewis 2620* (CANL). Frontenac Provincial Park, Tetsmine Trail, NW portion of the park, seasonally flooded lowlying area, 1.x.2016, on *Fraxinus* sp. trunk, *C.J. Lewis 2667* (CANL). PETERBOROUGH CO.: land adjacent to Otonabee Region Conservation Area agreement forest (Oatbox), N of Warsaw, 18.vi.2011, on large *Fraxinus sp.*, *C.J. Lewis & S.R. Brinker 610* (CANL); Otonabee Region Conservation Area agreement forest, N of Quakenbush Provincial Park, seasonally flooded mature deciduous forest stand, 30.ix.2012, on trunk of large *Fraxinus* sp., *C.J. Lewis 1413* (CANL). HASTINGS CO.: Crowe River floodplain S of Marmora, 4.v.2012, on mossy *Fraxinus* sp., *C.J. Lewis & S.R. Brinker 1075* (CANL); 7.0 km SE of Stoco Lake, 6.4 km E of Duff's Corners, W of Deroche Rd, seasonally flooded deciduous swamp in N-S trending gorge, 16.x.2012, on *F. pennsylvanica*, *S.R. Brinker 2790* (CANL); Desseronto Rd, 15km NW of Nappanee, 175 m N of Buttermilk Falls Road, in seasonally flooded deciduous swamp, 29.x.2014, on *F. pennsylvanica*, *C.J. Lewis 2142* (CANL). RENFREW CO.: along the Ottawa River 15 km ESE of Pembroke, 24.xi.2015, on bark of old *F. pennsylvanica* and *Quercus macrocarpa*, *S.R. Brinker 4776* (NY); Gervais Caves, Ottawa River, 15 km NE of Pembroke, in deciduous swamp with *Acer ×freemanii*, *F. pennsylvanica*, and *Ilex verticillata*, 8.v.2016, on bark of old *F. pennsylvanica*, *S.R. Brinker 4867* (CANL).

***Hyperphyscia syncolla* (Tuck. *ex* Nyl.) Kalb**

NOTES. – This is the second confirmed location of this species in Canada. Previously it was reported from four localities in Prince Edward County at Sandbanks Provincial Park by McMullin and Lewis (2013, 2014). This recent discovery, 40 km to the west of the previous reports is not surprising. The habitat at the site is similar to that found at Sandbanks Provincial Park with mature trees located along Lake Ontario with a south-facing aspect. This mainly southern species, seemingly reaching its northern limit in southern Canada, can be confused with the corticolous *Phaeophyscia orbicularis* (Necker) Moberg, but is much more closely attached to the substrate and lacks soredia (Brodo et al. 2001). *Phaeophyscia orbicularis* was observed growing alongside *H. syncolla* at Presqu'ile Provincial Park on large poplar trees growing in the coastal dune ecosystems.

Specimens examined. – **CANADA. ONTARIO.** NORTHUMBERLAND CO.: Presqu'ile Provincial Park, beach dune savannah close to shore, 11.vi.2015, on mossy *Populus* sp. trunk, *C.J. Lewis 2245* (CANL). PRINCE EDWARD CO.: Little Bluffs Conservation Area, large *Quercus* sp. trunk along lake shore, 16.iv.2016, on trunk, *C.J. Lewis 2580* (CANL); Massassauga Point Conservation Area, 6 km E of Rossmore along Lake Ontario shoreline, remnant *Quercus macrocarpa - Juniperus virginiana* savannah over limestone, 24.ix.2015, on mature *Q. macrocarpa*, *S.R. Brinker 4729* (CANL).

Lecanora carlottiana **C.J. Lewis & Śliwa**

NOTES. – These records expand the range of this recently described species from Ontario (Lewis & Śliwa 2012). The range extensions are not unexpected given the habitats these records were found in match the suitable habitat described in the original publication.

Specimens examined. – **CANADA. ONTARIO.** BRUCE CO.: Bruce Caves Conservation Area, moist dolomite cliff face in mixed forest, 16.iii.2016, on limestone, *C.J. Lewis, et al. 2283* (CANL). PRINCE EDWARD CO.: Long Point Nature Reserve, limestone cliff along lakeshore, 6.iv.2012, on rock in shade, *C.J. Lewis 988* (CANL), *C.J. Lewis 985* (KRAM; conf. L. Śliwa). FRONTENAC CO.: Lemoine Point Conservation Area, limestone cliff along lake shore, 28.xi.2015, on rock in shade, *C.J. Lewis 2287 & R.H. Lillicrap* (CANL).

****Lecanora epanora*** **(Ach.) Ach.**

FIGURE 2F

NOTES. – *Lecanora epanora* is here reported new for Canada from three recent collections in the Thunder Bay District, and one from Algonquin Provincial Park. *Lecanora epanora* is a metallophyte, typically associated with metal-rich rock, especially those with iron, and is often found on shaded overhangs and partially shaded cliffs (Earland-Bennett 1975). Elsewhere in its range, *L. epanora* has also been reported from iron-rich spoil heaps associated with old mine tailings and from "black-lime" mortar between siliceous coping blocks in polluted areas of England, where intense industrialization has resulted in the acidification of otherwise unsuitable substrates (Earland-Bennett 1975), and on sheltered soil and roots in the U.S. Pacific Northwest (McCune 2016). Its distribution in North America is poorly understood at present. Targeted surveys will likely result in additional records.

Specimens examined. – **CANADA. ONTARIO.** NIPISSING DIST. Algonquin Provincial Park, White Partridge Lake, on ledge above talus slope, in poplar stand, 30.vii.1972, on rock, *H.L. Dickenson 164 & D.F. Brunton* (CANL; det. T Tønsberg 2013). THUNDER BAY DIST.: Slate River Valley, 2.2 km SW of Moose Hill, at base of sheltered N-facing cliff above talus slope on vertical rock face, with *Rhizocarpon oderi*, 19.vii.2014, on rock, *S.R. Brinker 4032b* (NY; conf. J.C. Lendemer); Little Pigeon Bay Rd., 45 km SW of Thunder Bay, shaded moist rock face near entrance to old mine adit, 18.vii.2016, on vertical sedimentary (shale) rock, *S.R. Brinker 5092* (CANL); Castle Creek Provincial Nature Reserve, SW side of Whitefish Lake, 14 km SW of Silver Mountain, moist N-facing cliff with iron oxide staining, 25.viii.2016, on sedimentary (shale) rock, *S.R. Brinker 5408* (CANL).

Lecanora fugiens **Nyl.**

NOTES. – This is the second record from Ontario and the third from Canada for this inconspicuous species belonging to the *Lecanora dispersa* group. It is distinguished from other members of the group by its positive K and C thallus reaction and the distinct PD+ reaction (xanthones) of the apothecial disc (Śliwa 2007). The first Ontario collection was made by P.Y. Wong (*Wong 324,* CANL) in 1967 from the shore of Lake Opinicon north of Kingston (Śliwa 2007). The second record for Canada was from Fundy National Park in New Brunswick (*Gowan 4560*, CANL) (Śliwa 2007). In North America, only five other scattered localities are known (Maine, Minnesota, Wisconsin and California) (Śliwa 2007). It seems to prefer siliceous rock faces with high levels of humidity (Śliwa 2007).

Specimen examined. – **CANADA. ONTARIO.** FRONTENAC CO.: Salmon River, N of the Hamlet of Ardendale, adjacent to Hwy 7, growing on shaded NE facing cliff adjacent to low-lying area, 9.iii.2011, on rock, *C.J. Lewis 523* (KRAM; conf. L. Śliwa).

Lecanora juniperina **Śliwa**

NOTES. – This species was first reported from Ontario from Sandbanks Provincial Park by McMullin and Lewis (2014). It was considered a remarkable disjunct as it was thought to be a western temperate species (Śliwa 2007). Here we report an additional collection from Hastings County and a well as one from northwestern Ontario in the Kenora District. These discoveries may suggest a much larger distribution than previously thought. *Lecanora juniperina* is similar to *L. hagenii* (Ach.) Ach. in having distinctly pruinose apothecia and often dentate apothecia margins. The species is difficult to distinguish from *L. hagenii* without examining the epipsamma crystals and their reaction to K and N. It may also be superficially similar to *L. dispersa* due to its epihymenial granules (insoluble in K and N) and slender and branched paraphyses. However, compared to the latter species, it differs by having a more visible thallus and larger, pale-yellow pruinose apothecia with conspicuously crenulate margins (Śliwa 2007).

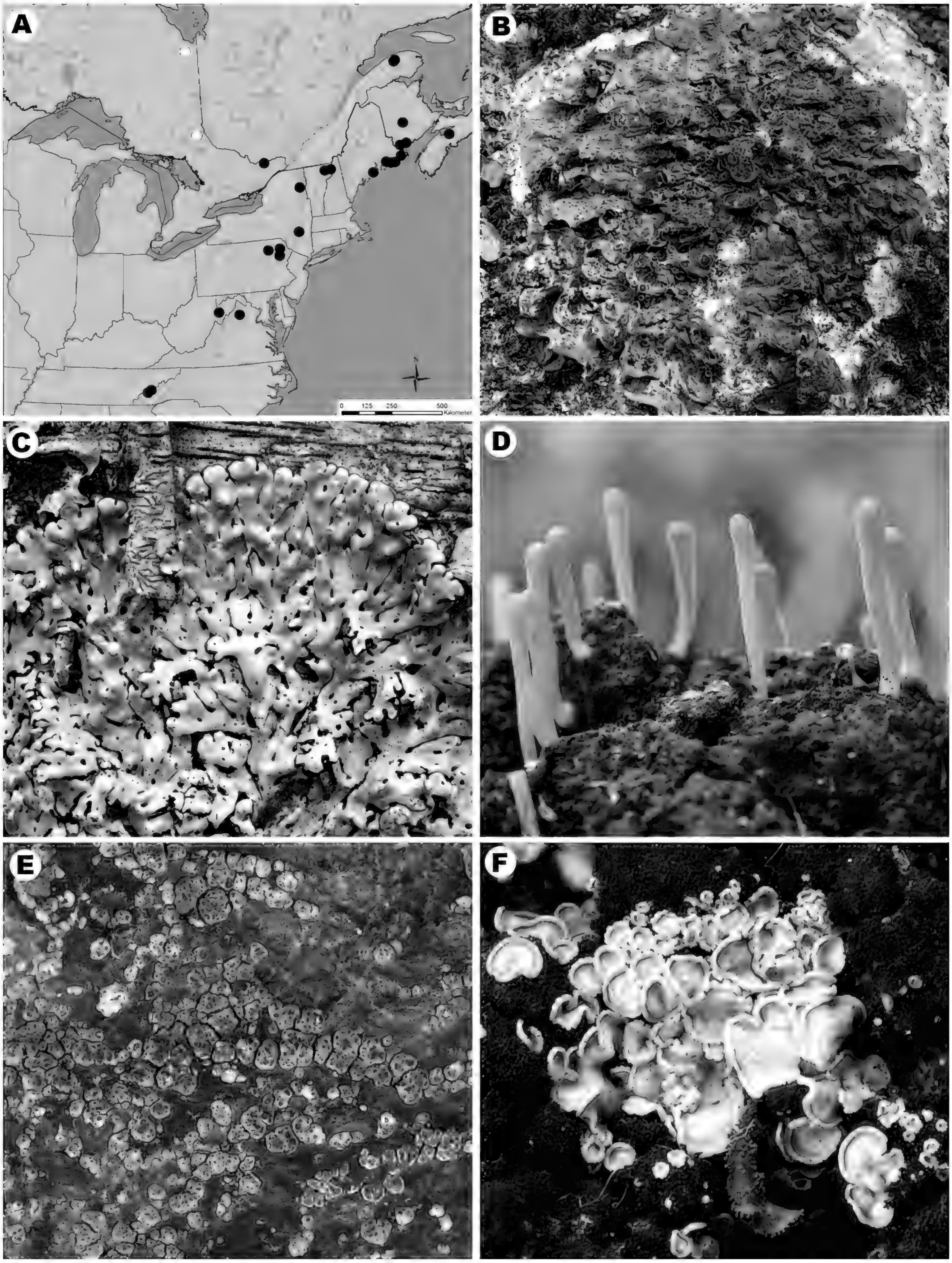

Figure 3. Photographs of species and distribution maps (white = new Ontario records, black = previous collections). **A,** distribution of *Lepraria humida* in North America. **B,** *Leptogium corticola,* on *Fraxinus nigra,* Parry Sound District. **C,** *Menegazzia subsimilis*, on *Betula alleghaniensis*, Peterborough County. **D,** *Multiclavula vernalis*, terricolous on calcareous soil, Hastings County. **E,** *Myriospora smaragdula* on iron-enriched rock. **F,** Detail of *Normandina pulchella* (dried specimen) on *Leptogium* sp.

Specimens examined. – **CANADA. ONTARIO.** HASTINGS CO.: Stoco Fen Nature Reserve, open fen with snags and fence posts, calcareous soils, 6.vii.2013, growing on fence post in the open, *C.J. Lewis 624a* (KRAM; det. L. Śliwa). KENORA DIST.: Lake of the Woods, Shoal Point, dry rock cliff by lake edge, S-facing, growing on exposed *Thuja,* 11.vii.2013, on rock, *C.J. Lewis 1598* (CANL).

***Lempholemma polyanthes* (Bernh.) Malme**

NOTES. – These are the first records of this species from Ontario since before 1930 (Wong & Brodo 1992). *Lempholemma polyanthes* is a relatively small, membranous, dark-green to black cyanolichen (Hinds & Hinds 2007). It is a calciphile, often found growing among bryophytes over limestone (Brodo et al. 2001, Hinds & Hinds 2007). The species often resembles, and may be confused with, free-living colonies of *Nostoc,* or small species of the lichen genus *Collema* (Hinds & Hinds 2007). Close examination of thalline ridges and lobe margins will reveal immersed apothecia and further study of those will reveal simple ascospores.

Specimens examined. – **CANADA. ONTARIO.** COCHRANE DIST.: Attawapiskat River, Attawapiskat Karst Formation, 64 km W of Attawapiskat Airport along the Attawapiskat River, limestone cliffs and moss covered boulders along the exposed river bank, 13.xii.2012, growing on thins soild over calcareous rock, *C.J. Lewis 1314* (CANL). FRONTENAC CO.: Frontenac Provincial Park, Arab Lake Trail, shaded mixed foreest, 18.ix.2016, on calcareous boulder, *C.J. Lewis 2593* (CANL); 37 km N of Kingston, SW portion of Devil Lake, 1.4 km ENE of Bear Lake, south-facing exposed marble ridge above steep slope to shoreline, 26.x.2016, on marble outcrop, *S.R. Brinker 5482* (CANL). MANITOULIN DIST.: Manitoulin Island, in the vicinity of "High Falls" along Hwy 6, mossy limestone cliff face, 5.x.2010, on rock, *C.J. Lewis 492* (CANL). HASTINGS CO.: Deroche Alvar S of Tweed, in shaded mixed forest, 7.iv.2011, atop mossy limestone boulders, *C.J. Lewis 581* (CANL); Callaghan's Rapids, 4.35 km S of Marmora centre, 800 m S of rail trail bridge, E channel of the Crowe River, shaded edge of rocky woods with *Quercus macrocarpa*, 5.vi.2012, on limestone pavement, *S.R. Brinker 2502* (CANL). OTTAWA-CARLTON CO. Panmure Alvar, Timmins Rd., *Juniperus virginiana* treed alvar on exposed, shallow-soiled limestone bedrock, 5.xi.2015, on soil, *C.J. Lewis 2233* (CANL).

***Lepraria humida* Slavíková-Bayerová & Orange**

NOTES. – These are the second and third reports of this species from Ontario. In North America, it is considered an Appalachian species, found from Tennessee north to New Brunswick and Newfoundland (Figure 3A) (Lendemer 2013). It is typically found in forests on moist but vertical, shaded siliceous rocks and rock faces with little or no bryophyte cover (Slavíková-Bayerová & Orange 2006).

Specimens examined. – **CANADA. ONTARIO.** NIPPISSNG DIST.: Temagami Lake Access Road, in mixed coniferous forest, along steep sided shaded creek valley with low lying area and shaded cliff faces, 24.vi.2012, on protected calcareous cliff face *C.J. Lewis 1120* (NY; det. J.C. Lendemer). COCHRANE DIST.: 55 km S of Moosonee airport, 1.8 km E of the Partridge River, extensive rock barren with scattered *Pinus banksiana,* 12.vi.2012, in moist granitic crevice, *S.R. Brinker 2652* (NY; det. J.C. Lendemer).

†*Leptogium corticola* (Taylor) Tuck.

FIGURE 3B

NOTES. – These are the first Ontario records of this species in over 140 years. *Leptogium corticola* was previously known in Ontario from several 19th century collections made by John Macoun from Hastings, Northumberland, and Prince Edward counties (Wong & Brodo 1992). *Leptogium corticola* is a temperate, southeastern North American corticolous species at its northern range limit in Ontario (Sierk 1964). Our collections were all made in remnant stands of mature, transitional and boreal forest with a cedar component. Cameron and Richardson (2006) included *L. corticola* in a small group of rare cyanolichens restricted in Nova Scotia to coastal forests with frequent fog. It is designated "Yellow" or "Sensitive" by the Nova Scotia Department of Natural Resources (Anderson 2007) and was listed as declining in the northeast United States by Hinds and Hinds (2007). It is also considered a Group 2 mid-priority candidate species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2015).

Specimens examined. – **CANADA. ONTARIO.** LANARK CO.: White Lake, N of Peneshula Rd., 20 km W of Pakenham, in mixed swamp with *Thuja occidentalis*, *Fraxinus nigra* and *Abies balsamea*, 23.vi.2015, on mossy *Fraxinus nigra*, *S.R. Brinker 4486 & R.E. Lee* (CANL). THUNDER BAY DIST.: S

end of Ouimet Canyon, 60 km NE of Thunder Bay, in coniferous forest along steep rocky slope with *Acer spicatum*, 4.viii.2015, on *Thuja occidentalis*, *S.R. Brinker 4694* (CANL); Albert Lake Mesa, 53 km E of Nipigon, 23 km SW of Black Sturgeon Lake, in cedar swamp with *A. balsamea*, *A. spicatum and Taxus canadensis*, 16.vii.2016, on bark of *T. occidentalis*, *S.R. Brinker 5067* (CANL); 59 km SW of Thunder Bay, 10 km E of South Fowl Lake, in mature, mixed swamp with *F. nigra*, *T. occidentalis* and *A. spicatum*, 17.vii.2016, on bark of *F. nigra* and *T. occidentalis*, *S.R. Brinker 5089* (CANL). PARRY SOUND DIST.: N side of Spring Lake Rd., 21 km N of Magnetewan, 12 km W of Bummer's Roost, on N-facing slope with *Ulmus americana*, *T. occidentalis*, *Acer spicatum*, and *Lonicera canadensis*, 24.v.2016, on bark of very old *F. nigra*, *S.R. Brinker 4911* (CANL). KENORA DIST.: Ojibway Provincial Park, 18 km SW of Sioux Lookout, edge of coniferous forest along Little Vermillion Lake with *T. occidentalis*, *A. balsamea* and *Picea mariana*, 18.vii.2016, on bark of *T. occidentalis*, *S.R. Brinker 5132* (CANL).

†*Lithothelium septemseptatum* (R. C. Harris) Aptroot

NOTES. – *Lithothelium septemseptatum* was considered rare in southern Ontario by Wong and Brodo (1992, as *Plagiocarpa septemseptata* R.C. Harris), where it was known from several 19th century collections made by John Macoun. This is the first published record for the province in over a century. Elsewhere in the Great Lakes region, Harris (1973) considered it to be locally abundant in Michigan where it was most commonly reported on *Fraxinus*, but occasionally on *Acer saccharum*, *Quercus*, *Thuja*, and *Ulmus*.

Specimen examined. – **CANADA. ONTARIO.** PETERBOROUGH CO.: 3 km E of Fraserville along Otonabee River, mature deciduous floodplain swamp with *Fraxinus pennsylvanica*, *Acer ×freemanii* and *Quercus macrocarpa*, 1.ii.2016, on bark of large *F. pennsylvanica*, *S.R. Brinker 4789* (CANL; det. I.M. Brodo).

***Menegazzia subsimilis* (H. Magn.) R. Sant.**

FIGURE 3C

NOTES. – These are the first confirmed reports of *Menegazzia subsimilis* for Ontario. It was also collected in 2011 in Lanark County (*Lendemer 28229*, NY[n.v.]) and was reconfirmed in the same area in 2015 by the second author (specimen cited below). *Menegazzia subsimilis* is most often found on the bark of deciduous trees, though occasionally it also occurs on shaded rock in especially humid situations (Hinds & Hinds 2007). The morphologically similar *M. terebrata* (Hoffm.) A. Massal. was considered an old-growth indicator by Selva (1989), and our observations of *M. subsimilis* are from remnant mature to old-growth forest stands, suggesting this species is similarly restricted to old forests in Ontario.

Specimens examined. – **CANADA. ONTARIO.** LANARK CO.: White Lake, N of Peneshula Rd., 20 km W of Pakenham, mixed conifer swamp with *Thuja occidentalis*, *Fraxinus nigra*, and *Abies balsamea*, 23.v.2015, on *T. occidentalis*, *S.R. Brinker 4489* (CANL). NIPISSING DIST. Algonquin Provincial Park, High Falls Trail, mature cedar forest beside the York River, in humid old forest stand, 30.iii.2010, on *T. occidentalis*, *C.J. Lewis 362* (CANL). PETERBOROUGH CO.: 1.5 km W of Vansickle, 5 km E of Oak Lake, conifer swamp with *T. occidentalis*, *Picea glauca*, *F. nigra*, and *Betula alleghaniensis*, 29.iv.2016, on *B. alleghaniensis*, *S.R. Brinker 4830* (CANL). FRONTENAC CO.: 11 km N of Plevna, 500 m E of Brule Lake, conifer swamp with *T. occidentalis*, *A. balsamea* and *B. alleghaniensis*, 15.ix.2016, on *B. alleghaniensis*, *S.R. Brinker 5438* (CANL). PARRY SOUND DIST.: W side of Spring Lake Rd., 29.5 km W of South River, 5.3 km WNW of Spring Lake, small conifer swamp with *Tsuga canadensis*, *A. balsamea*, *Acer rubrum* and *Picea mariana*, 27.v.2016, on bark of *T. occidentalis*, *S.R. Brinker 4925* (CANL). ALGOMA DIST.: Lake Superior Provincial Park, Sand River, 61 km S of Wawa, edge of mixed forest along river with *A. balsamea*, *B. alleghaniensis*, *A. spicatum*, and *T. occidentalis*, 11.vii.2016, on *T. occidentalis*, *S.R. Brinker 4948* (CANL).

***Microcalicium arenarium* (Hampe ex A. Massal.) Tibell**

NOTES. – *Microcalicium arenarium* is a non-lichenized fungus known to parasitize both algae and lichens (Ahti 1999). As with many other calicioids, it is sensitive to disturbance and is considered old-growth forest dependent given its slow growth and limited dispersal ability (Selva 1988, 1994). *Microcalicium arenarium* was reported new to Ontario by Wong and Brodo (1990) from Hastings County, and more recently mentioned by Lewis (2010) from the Temagami area from talus habitat with *Psilolechia clavulifera* (Nyl.) Coppins, and *P. lucida* (Ach.) M. Choisy. The following records are the only other recent

Ontario collections to our knowledge. It should be looked for in humid areas with mature forest wherever species of *Psilolechia* are found.

Specimens examined. – **CANADA. ONTARIO.** KENORA DIST.: 47 km SE of Sandy Lake airport, ca. 4 km SSE of McKendry Lake, near Roseberry River on shaded N-facing cliff, 7.vii.2011 parasitic on *Psilolechia lucida* (Ach.) M. Choisy, *S.R. Brinker 2167b* (CANL). NIPISSING DIST.: South Lorrain Township, approximately 17.5 km E of Temagami and 82 km N of North Bay on underside of a rock overhang on a treed talus slope on the shore of the Matabichuan River, 28.vi.2008, parasitic on *P. lucida, C.J. Lewis 169* (CANL); Algonquin Provincial Park, Barron Canyon, on a talus slope in crevasse, 8.viii.2010, parasitic on *P. lucida*, *C.J. Lewis 457* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, large SE bay of Ottertrack Lake along N shore, 75 km SE of Atikokan, S-facing talus slope below exposed cliff, 17.viii.2016, in shaded crevice of boulders parasitic on *P. lucida*, *S.R. Brinker 5222b* (CANL).

Multiclavula mucida (Pers.) R.H. Petersen

NOTES. – *Multiclavula mucida* was first reported for Ontario by Wong and Brodo (1992). It is a lichen-forming basidiomycete, that together with *M. vernalis*, are the only basidiolichens currently known to occur in southern Ontario. The lichenized thallus is composed of small bulbils of algal cells surrounded by a thick layer of fungal hyphae (Nelsen et al. 2007, Oberwinkler 1984), and the thallus covers the substrate from which fruiting bodies (basidiocarps) are occasionally produced. Because the cream-coloured or yellowish basidiocarps are not perennial, records of *M. mucida* are scarce. Unlike *M. vernalis* which is typically reported from soil, *M. mucida* is normally found on moist, shaded rotting logs, and is reportedly more frequent and widespread than *M. vernalis* (Brodo et al. 2001).

Specimens examined. – **CANADA. ONTARIO.** HASTING CO.: Menzel Centennial Provincial Nature Reserve, 18 km SE of Tweed, Ontario, 29.x.2014, growing on decayed log in a treed wetland, *C.J. Lewis 2145* (CANL); LANARK CO.: 22 km S of Calabogie, Hwy 511 off of the French Line, mixed deciduous forest with low-lying areas and high ridges, 10.xii.2015, *C.J. Lewis 2268* (CANL).

***Multiclavula vernalis* (Schwein.) R. Petersen.**

FIGURE 3D

NOTES. – This is the first report of *Multiclavula vernalis* for Ontario. While not all species in the genus are lichen-forming, *M. vernalis* does enclose its algal partner in small capsules of mycelial tissue, though essentially unstructured (Voitik & Ohenoja 2011). *Multiclavula vernalis* is terricolous and the fungal hyphae are associated with algae (*Coccomyxa*) (Petersen 1967, Voitik & Ohenoja 2011). When produced, the basidiocarps are club-shaped, and cream to orange in colour (Figure 3D), up to 2 centimeters tall.

Specimens examined. – **CANADA. ONTARIO.** HASTING CO.: Tweed, Ontario, Cassidy Block - MVCA property, Deroche Road, 25.iv.2014, on calcareous soil in a treed alvar opening with *Juniperus virginiana, C.J. Lewis 1867* (CANL), on calcareous soil, *S.R. Brinker 3335* (NY).

***Myriospora smaragdula* (Wahlenb. ex Ach.) Nägeli ex Uloth**

FIGURE 3E

NOTES. – The genus *Myriospora* Nägeli *ex* Uloth corresponds to the former *Acarospora smaragdula* group, as well as the recently described genus *Silobia* M. Westb. & Wedin (Wedin et al. 2009), both now considered synonyms of *Myriospora* (Arcadia & Knudsen 2012). A single specimen from Ontario was mapped by Thomson (1997) (as *A. smaragdula*) from Michipicoten Island in Lake Superior, and one from the Boundary Waters Canoe Area in adjacent Minnesota was also mapped by Thomson (1997). Elsewhere in North America, it has been reported as a circumpolar subarctic and alpine species (Thomson 1997) that grows on heavy-metal rich rocks, especially those containing iron or copper (Fletcher et al. 2009). We report *Myriospora smaragdula* from two additional locations in the Thunder Bay region.

Specimens examined. – **CANADA. ONTARIO.** THUNDER BAY DIST.: Slate Islands Provincial Park, Lake Superior, W shore of Patterson Island, 500 m N of Pass Lake, exposed rocky shoreline, 16.vii.2014, on sheltered rock with band of iron-rich oxide precipitate, *S.R. Brinker 3977* (NY); Slate Islands, small island E of Delute Island, shore and few junipers on higher center of the island, 15.vii.1977, *C.M. Wetmore 28737* (CANL); Little Pigeon Bay Rd., 45 km SW of Thunder Bay, shaded, moist rock face near entrance to old mine adit, 18.vii.2016, on sheltered vertical sedimentary (shale) rock, *S.R. Brinker 5093* (CANL).

***Normandina pulchella* (Borer) Nyl.**

FIGURE 3F

NOTES. – First reported from Ontario by McMullin et al. (2015) based on collections from the Slate Islands in Lake Superior, the Barron Canyon in Algonquin Park, and from a cliff along the St. Lawrence River in eastern Ontario. These additional collections are the first mainland records from the Thunder Bay District. *Normandina pulchella* is often epiphytic on other lichens or bryophytes (Motiejūnaitė et al. 2013) where its diminutive squamules (up to 2 mm in diameter) can easily go undetected (Hinds & Hinds 2007). It was considered an old-growth indicator of humid northern hardwoods and spruce-fir stands in Maine, New Hampshire, Vermont, and western New Brunswick by Selva (1994).

Specimens examined. – **CANADA. ONTARIO.** THUNDER BAY DIST.: Lookout Trail, Pigeon River Provincial Park, 500 metres E of Little Falls, in humid narrow floodplain forest along Pigeon River, 19.vii.2014, on *Leptogium saturninum*, *S.R. Brinker 4044B* (CANL); The Pinnacles, 5.5 km NW of Dorion, 1 km N of Miner Lake, shaded, mossy E-facing cliff under *Acer spicatum*, 20.vii.2014, on *Leptogium* sp., *S.R. Brinker 4060B* (CANL); Ouimet Canyon, 8 km W of Dorion, 500 m E of Welburn Lake, shaded rock face and adjacent talus slope, 20.vii.2014, on *Pannaria conoplea*, *S.R. Brinker 4083b* (CANL).

***Opegrapha mougeotii* A. Massal.**

NOTES. – This is the second published record for Ontario and the fourth for North America. This first published record was discovered during the 17th Tuckerman Workshop in 2008 on the Bruce Peninsula (Brodo et al. 2013).

Specimen examined. – **CANADA. ONTARIO.** GREY CO.: Inglis Falls Conservation Area S of Owen Sound, on the banks of the Sydenham River growing on calcareous rock, 25.ix.2010, *C.J. Lewis 488* (CANL).

***Opegrapha rufescens* Pers.**

NOTES. – This species was first discovered in Ontario during the 17th Tuckerman Workshop in 2008 on the Bruce Peninsula (Brodo et al. 2013). It is a striking species, with a rusty orange thallus, and seems to be relatively rare in Canada. Only one other collection is known and it was made by Irwin Brodo in 1971 on Haida Gwaii in British Columbia (*I.M. Brodo 18041*, CANL!).

Specimen examined. – **CANADA. ONTARIO.** HASTINGS CO.: along Hwy 7 W of Marmora, E of Havelock, N side of the Hwy, in *Thuja*-dominated forest on a limestone cliff ridge, 23.iii.2011, on mature *Populus* sp., *C.J. Lewis 540a* (NY), *C.J. Lewis 540b* (CANL).

***Parmelia neodiscordans* Hale.**

NOTES. – This is the first confirmed report of this species from Ontario. *Parmelia neodiscordans* primarily distributed in eastern North America where it is known from scattered records in the Appalachian Mountains from North Carolina to Maine (Figure 4A). There are also three records from western North America (Yukon) where it is rare (Hinds 1998). It can be locally common on talus slopes and rocky openings in the east (Lendemer et al. 2009).

Specimen examined. – **CANADA. ONTARIO.** TEMISKAMING DIST.: S of Haileybury, Devils Rock/Peak, growing on talus slope along the western shore of Lake Temiskaming, 7.vii.2012, on rock, *C.J. Lewis 1185 & S.R. Brinker* (CANL; conf. J.C. Lendemer).

***Parmeliella triptophylla* (Ach.) Müll. Arg.**

NOTES. – *Parmeliella triptophylla* has a limited distribution in Ontario that is centered in the northern and eastern Lake Superior basin (Brodo et al. 2001). Mainly a coastal and montane species, it requires cool humid forests (Brodo et al. 2001) and is an indicator of old-growth forests (Hinds & Hinds 2007).

Specimens examined. – **CANADA. ONTARIO.** ALGOMA DIST.: Lake Superior Provincial Park, Old Woman Bay, Nokomis Trail, 14.vii.1993, on a shaded mossy *Populus* sp., *S.Sharnoff & S.Sharnoff 1120.32* (CANL), 18.xiii.2013, *C.J. Lewis 1395* (CANL). THUNDER BAY DIST.: Sleeping Giant Provincial Park, S side of Poundsford Lake, in mature mixed forest with *Thuja occidentalis*, *Pinus strobus* and *Populus* spp., 21.vii.2014, on bark of mature *Populus tremuloides*, *S.R. Brinker 4096* (CANL); Michipicton Island Provincial Park, Lake Superior, 600 m E of Schafer Bay, old-growth *Acer saccharum* deciduous forest on N-facing slope with *Taxus canadensis* and *Acer spicatum*, 28.xii.2015, on *A. saccharum*, *S.R. Brinker 4534* (CANL); Lake Nipigon, S shore of Grand Bay, 70 km N of Nipigon, mixed

forest fringe at base of cliff and lake with *Abies balsamea* and *Betula papyrifera*, 12.vii.2016, on *B. papyrifera*, *S.R. Brinker 4963* (CANL);12 km E of Nipigon, 0.5 km SE of East Moseau Lake, old conifer forest with *T. occidentalis*, *Betula papyrifera*, and *A. balsamea*, 14.vii.2016, on bark of *T. occidentalis*, *S.R. Brinker 5001* (CANL).

****Parmotrema hypotropum (Nyl.) Hale**

FIGURE 4B

NOTES. – *Parmotrema hypotropum* is here reported new for Canada. Two Canadian specimens identified as this taxon were located in online databases. However, a duplicate of one of these examined at CANL proved to be *Parmeliopsis hyperopta* (Ach.) Arnold (*L. Sirois & F. Lutzoni 1065-L15*, CANL), and the other (*Rev. W. W. Perrott s.n.*, FH) has been annotated "*it is wholly doubtful if this was found by Rev. W.W. Perrott in Labrador*". *Parmotrema hypotropum* is a widespread southeastern North American species found from New England south to Florida and west to Texas (Lendemer et al. 2015). Our records represent the most northerly published stations for this species (Figure 4C). Accounts from coastal California and the extreme southeastern coastal plain are *P. hypoleucinum* (Brodo et al. 2001, Lendemer et al. 2015) which is nearly identical, but the medulla is PD+ orange, K+ yellow to orange, AI+ blue, with stictic acid as its main chemical component (along with norstictic acid). All but one of our Ontario collections of *P. hypotropum* are from near-coastal areas of Lake Erie on well-lit tree bark or twigs. One inland record roughly 5 km north of Lake Erie is from a humid creek valley.

Specimens examined. – **CANADA. ONTARIO.** CHATHAM-KENT CO.: mouth of Clear Creek at Lake Erie off Clearville Rd, 25 km SE of Thamesville, in small deciduous swamp surrounded by successional lowland forest, 10.vi.2015, on trunk of *Fraxinus pennsylvanica, S.R. Brinker 4468* (CANL); Rondeau Provincial Park, 6 km E of Erieau on Lake Erie, deciduous swamp with *F. pennsylvanica* and *Acer saccharinum*, 10.vi.-2015, on trunks of dead *F. pennsylvanica* succumbed to invasive Emerald Ash Borer beetle, *S.R. Brinker 4471* (CANL). ESSEX CO.: Point Pelee National Park, along Redbud footpath S of park visitor centre, in successional *Cornus drummondii* thicket, 12.vi.2015, on introduced (planted) *Cercis canadensis* along trail, *S.R. Brinker 4478* (CANL). NORFOLK CO.: Young's Creek, 1.5 km NW of Vittoria, thicket swamp with *Salix* spp., and *Betula pumila*, 10.vi.2015, on twig of *Larix laricina*, *S.R. Brinker 4742* (CANL); Turkey Point Provincial Park, 2.2 km W of Normandale, 800 metres N of Lake Erie, edge of *Quercus velutina* woodland, 27.xii.2015, on twig of planted *Pinus resinosa*, *S.R. Brinker 4783* (CANL); 1.7 km NW of Normadale, 2.8 km W of Fishers Glen, edge of conifer plantation, 09.x.2016, on *Picea glauca* twig, *S.R. Brinker 5460* (CANL). HALDIMAND CO.: James N. Allen Provincial Park, 20 km SE of Cayuga, edge of deciduous woods along Lake Erie shore, 26.iii.2016, on exposed trunk of *Fraxinus* sp., *S.R. Brinker 4816* (CANL).

†*Phaeophyscia hispidula* ssp. *hispidula* (Ach.) Essl.

NOTES. – These records represent the first discoveries of this species in southern Ontario since those made in 1930 by John Macoun near Belleville in eastern Ontario (Wong & Brodo 1992). *Phaeophyscia hispidula* is easily distinguished from all other *Phaeophyscia* species in northeastern North America by its wide lobes (1–4 mm) that are often concave (Hinds & Hinds 2007).

Specimens examined. – **CANADA. ONTARIO.** CITY OF KAWARTHA LAKES: Norland, on the shore of the Gull River, 270 m E on Hwy 45 of the intersection with Hwy 35, on a shaded mossy boulder (erratic) adjacent to the parking lot, 31.iii.2010, *C.J. Lewis 390* (CANL). FRONTENAC CO.: Forestry Access Road (extension of Arcol and Dam top Rd.) N Canonto Twp., W of Norcan Lake, in mixed hardwood forest on a slope with a N facing aspect, 3.iii.2012, on mossy thick-barked *Ostrya virginiana*, *C.J. Lewis 980* (CANL). LANARK CO.: Black Creek, 20 km NE of Lanark, in mature forest, 10.x.2014, on *O. virginiana*, *C.J. Lewis 2140* (CANL); 17 km S of White Lake, 25 km WNW of Carleton Place, Ontario, old growth sugar maple forest, 24.x.2004, on *O. virginiana*, *Brodo 31697* (CANL); Hwy 511, 20 km S of Calabogie, mixed mature deciduous forest with ridges, 8.iv.2016, on mossy calcareous *O. virginiana* trunk, *C.J. Lewis 2299* (CANL). PETERBOROUGH CO.: N of Chandos Lake, creek valley in mature forest, 19.xi.2012, on *Acer* sp., *C.J. Lewis 1422 & S.R. Brinker* (CANL); Stoney Lake, mixed deciduous woods, open field with large granitic boulders 4.x.1988, on *Quercus*, *P.Y.Wong 4404* (CANL). THUNDER BAY DIST.: Sleeping Giant Provincial Park, 28 km E of Thunder Bay, 1 km S of Sawyer Bay, shaded talus slope below cliff in mixed forest with *Betula papyrifera*, *Thuja occidentalis* and *Abies balsamea*, 26.viii.2016, on mossy sedimentary (conglomerate) rock, *S.R. Brinker 5425* (CANL).

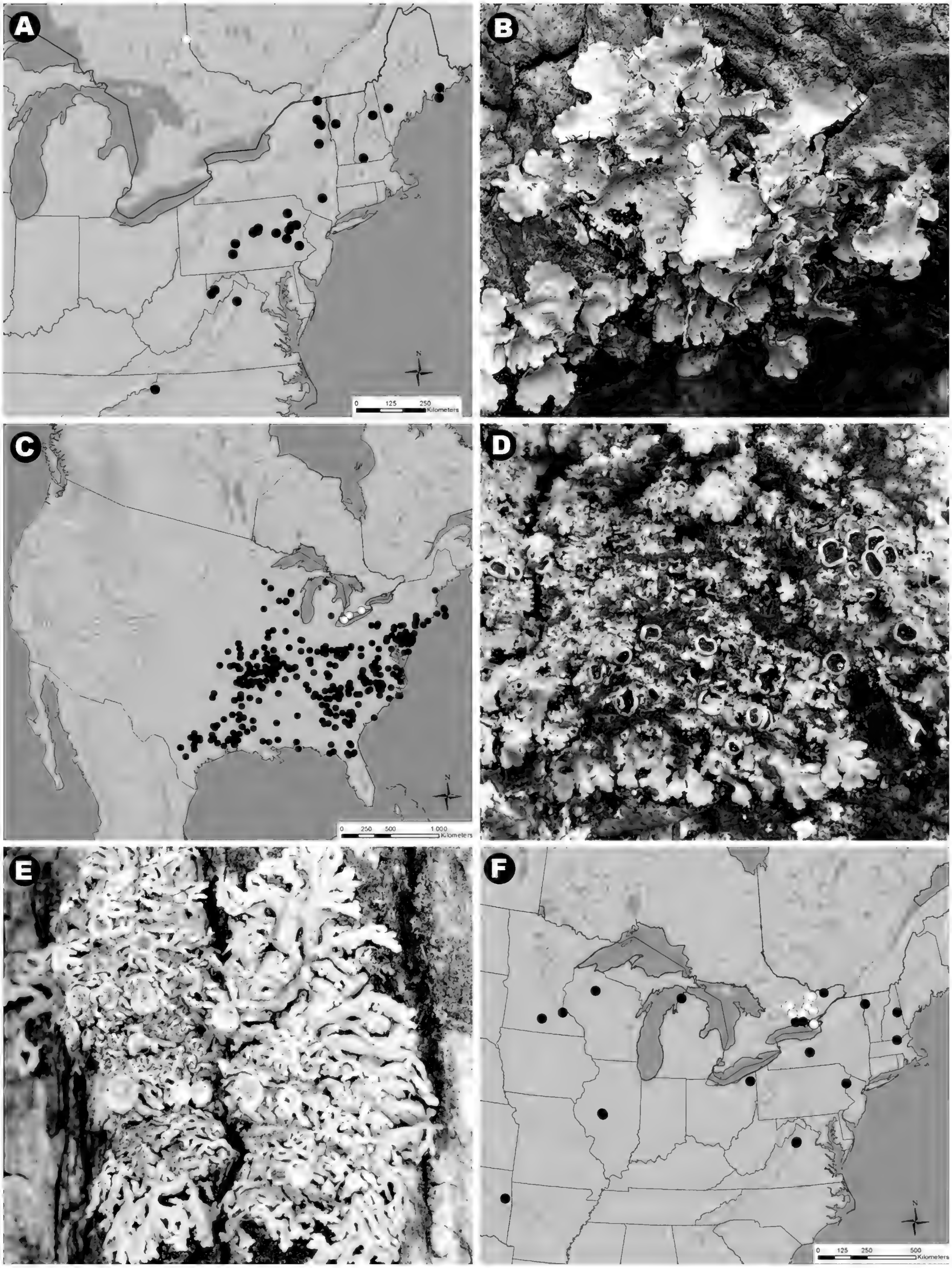

Figure 4. Photographs of species and distribution maps (white = new Ontario records, black = previous collections). **A,** distribution of *Parmelia neodiscordans* in North America. **B,** *Parmotrema hypotropum* habit, Elgin County. **C,** distribution of *Parmotrema hypotropum* in North America. ***D,*** *Phaeophyscia squarrosa,* on shaded boulder, Renfrew County. **E,** *Physconia subpallida* habit, on *Ostrya virginiana*. **F,** *Physconia subpallida.*

***Phaeophyscia squarrosa* Kashiw.**

FIGURE 4D

NOTES. – These are the only recent reports of this species from the province since it was originally found in the Petawawa Research Forest in Renfrew County, and also reported from Durham County (Wong & Brodo 1992). A distinctive *Phaeophyscia* species, it has a lobulate thallus and a white lower surface (Brodo et al. 2001). It was reported as relatively rare in Canada (Goward et al. 1998), though is likely under-collected and more common than current records indicate.

Specimens examined. – **CANADA. ONTARIO.** LANARK CO.: Clyde Forks, Ontario, Lanark Highlands area s of Calabogie, rich deciduous forest with calcareous cliffs, 17.viii.2015, *C.J. Lewis 2156* (CANL); 22 km s of Calabogie, Hwy 511 off of the French Line, mixed deciduous forest with low-lying areas and high ridges, 10.x.2015, *C.J. Lewis 2268* (CANL); Hwy 511 near "New Road", 20 km S of Calabogie, in mature hard wood forest, 15.iii.2016, on mossy *Ulmus* sp., *C.J. Lewis 2276* (CANL). Hwy 511, 20 km S of Calabogie, mixed mature deciduous forest with ridges, 8.iv.2016, on mossy calcareous *Ostrya virginiana* trunk, *C.J. Lewis 2300* (CANL). HALIBURTON CO.: Little Esson Lake, 33 km W of Bancroft, 3.5 km W of Wilberforce, in small deciduous swamp with *Fraxinus nigra* and *Ulmus americana*, 25.v.2016, on bark of *F. nigra*, *S.R. Brinker 4863* (CANL; det. I.M. Brodo). RENFREW CO.: Mountain Chute Station at Norcan Lake, conifer woods on S-facing slope with *Thuja occidentalis*, *Pinus resinosa* and *Picea glauca*, 9.vi.2016, on shaded metamorphic (marble) rock, *S.R. Brinker 4878* (CANL).

***Physcia americana* G. Merr.**

NOTES. – Until recently, the only Ontario records of this species were historical, made by John Macoun in eastern Ontario in 1930 (Wong & Brodo 1992). The following records, along with the only other contemporary published account from Flowerpot Island (Brodo et al. 2013) reconfirm its presence in southern Ontario.

Specimens examined. – **CANADA. ONTARIO.** BRUCE CO.: Greenock Swamp Conservation Area, 10 km NW of Walkerton, Ontario, Con Rd 6, mature *Acer rubrum-Fraxinus* swamp, 21.xii.2015, on mossy *Acer* sp. trunk, *C.J. Lewis 2271* (CANL). GREY CO.: Eugenia Falls Conservation Area in the Hamlet of Eugenia, shore the Beaver River, on mature *Acer saccharum* trunk in parking lot, 26.ix.2010, *C.J. Lewis 480* (CANL). FRONTENAC CO.: Salmon River, N of the Hamlet of Ardendale along the Salmon River, in a low lying deciduous floodplain, 24.ii.2011, on trunk of *Fraxinus* sp., *C.J. Lewis 506* (CANL); Frontenac Provincial Park, 18 km N of Sydenham, S of Clearwater Lake, edge of deciduous swamp, 3.vii.2012, on *Fraxinus pennsylvanica*, *S.R. Brinker 2521* (CANL). HASTINGS CO.: Moira River, 3 km S of Actinolite, 6.5 km E of Moira Lake, just S of the confluence of the Skootamata River, in humid, sandy deciduous floodplain forest, 8.vi.2012, on bark of *F. pennsylvanica*, *C.J. Lewis 1171 & S.R. Brinker* (CANL). PETERBOROUGH CO.: S of Quackenbush Provincial Park, 2.0 km S of the intersection of Rd. 6 and Hwy 44, vernal pool, growing on flooded ash tree base, 30.ix.2012, *C.J. Lewis 1414b* (CANL).

***Physconia subpallida* Essl.**

FIGURE 4E

NOTES. – Prior to these additional records, which include the first reports for the counties of Prince Edward and Haliburton (Figure 4F), *Physconia subpallida* was only known in Canada from several historical collections made by John Macoun in Brighton, Belleville, Brittania and Ottawa (Lewis 2011). Its preference for undisturbed mature forests or areas exhibiting similar microclimatic characteristics has likely led to its demise at many of its former sites (Lewis 2011). Indeed, limited population trend data suggest this lichen has decreased dramatically due to the loss of habitat (i.e. loss of elms due to disease, cutting of old growth hardwood forests, and increased air pollution) (Lewis 2011). Due to these impacts, and its rarity, this species was given an "Endangered" status in Canada by Committee on the Endangered Wildlife in Canada (COSEWIC 2009). There are several distinctive characters of this species to separate it from other eastern *Physconia* species, which include the absence of isidia and soredia, the presence of lobulate apothecia and/or lobules with pycnidia, and the pale corticate lower surface with clustered squarrose rhizines (Esslinger 1994, Lewis 2011, McMullin 2015a) Other species of *Physconia* can be fertile, but this is uncommon. *Anaptychia palmulata* can also appear similar and it also has an entirely pale lower surface, but it has simple and bunched rhizines and lacks pruina on the apothecia and lobes which is typical of *Physconia* (Esslinger 1994).

Specimens examined. – **CANADA. ONTARIO.** FRONTENAC CO.: Salmon River, N of the Hamlet of Ardendale, along Salmon River, low lying deciduous floodplain, 24.ii.2011, on trunk of

Fraxinus sp., *C.J. Lewis 505* (CANL); Frontenac Provincial Park, 18 km N of Sydenham, S of Clearwater Lake, in shaded gorge of rich deciduous forest with local marble outcrops, 3.vii.2012, on *Fraxinus pennsylvanica*, *S.R. Brinker 2513* (CANL); Slide Lake small loop Trail, at the base of a N facing slope adjacent to a wetland, 20.ii.2017, on *Fraxinus sp*. Trunk, *C.J. Lewis 2798* (CANL). HALIBURTON CO.: 3.8 km ESE of Wilberforce, 220 m W of Hall's Lake, W side of forest access road, on E facing slope of mature deciduous forest with *Acer saccharum*, *Fraxinus americana*, *Tilia americana*, and *Fagus grandifolia*, 19.iii.2013, on *Ostrya virginiana*, *S.R. Brinker 2812 & G. Cameron* (CANL). HASTINGS CO.: Moira River, 3 km S of Actinolite, 6.5 km E of Moira Lake just S of the confluence of the Skootamata River, in humid, sandy deciduous floodplain forest, 8.vi.2012, on bark of *F. pennsylvanica*, *S.R. Brinker 2507 & R. Craig* (CANL); Cassidy Block, 7 km SE of Stoco Lake, 6.4 km E of Duff's Corners, W of Deroche Rd., in seasonally flooded deciduous swamp of N–S-trending gorge, 16.x.2012, on *F. pennsylvanica*, *S.R. Brinker 2790* (CANL); 4 km S of Paudash, 800 m W of Crowe River, just N of Lowrie Lake Rd., in rocky deciduous forest with *Quercus rubra*, *A. saccharum*, and *F. americana,* 5.iv.2013, on *Ostrya virginiana*, *S.R. Brinker 2818 & G. Cameron* (CANL); Kingsford, Desseronto Rd., 15 km NW of Nappanee, 175 m N of Buttermilk Falls Road, in seasonally flooded deciduous swamp in, 15.ix.2016, on *F. pennsylvanica*, *C.J. Lewis 2578* (CANL). LANARK CO.: Hwy 511 near Tatlock Quarry, in mature *Ostrya virginiana* glade with in a mixed forest, calcareous soils, 15.iii.2016, on mossy trunk of *O. virginiana*, *C.J. Lewis 2274* (CANL); Hwy 511 near "New Road", 20 km S of Calabogie, Ontario, in mature hard wood forest, 15.iii.2016, on mossy *Ulmus americana*, *C.J. Lewis 2275* (CANL); Black Creek Rd, 20 km NE of Lanark, in forest block 308, in mature forest, 16.iii.2016, on *O. virginiana*, *C.J. Lewis 2279* (CANL); Black Creek Rd., 20 km NE of Lanark, in forest block 400, in mature forest, 10.x.2014, on *O. virginiana*, *C.J. Lewis 2139* (CANL). Lavant Darling Rd., 20 km SW of Calabogie, N of the hydro cut on the NE facing ridgeline, mixed mature deciduous forest with ridges, 19.iv.2016, on mossy *Ostrya virginiana* trunk, *C.J. Lewis 2322* (CANL). PETERBOROUGH CO.: Norwood, Peterborough County forest along the most southern hydro corridor, 20-ix.2012, on large mossy *Fraxinus* sp. trunk, *C.J. Lewis 1412 et al.* (CANL). PRINCE EDWARD CO.: Main Duck Island, Lake Ontario, St. Lawrence Islands National Park, in mature remnant deciduous woods with *A. saccharum* and *Carya ovata*, 24.ix.2013, on *O. virginiana*, *S.R. Brinker 3237* (CANL); Massassauga Point, 6 km E of Rossmore, in remnant *Quercus - Juniperus virginiana* savannah, 24.ix.2015, on *Quercus macrocarpa*, *S.R. Brinker 4730* (CANL). RENFREW CO.: Calabogie, on the NE side of Calabogie Peaks Resort Mountain, 12.iv.2009, on *Ostrya virginiana* among mosses, *C.J. Lewis 318* (CANL), *C.J. Lewis 319* (OAC); W side of Kennelly Mountain Rd., 1.5 km S of Kennelly Lake, deciduous forest with *A. saccharum*, *O. virginiana*, *Populus tremuloides* and *Q. rubra*, 23.vi.2015, on *O. virginiana*, *S.R. Brinker 4498*, (CANL); Centennial Lake Provincial Nature Reserve, 17 km W of Calabogie Lake, 200 m N of Oakhill Lake, deciduous forest in valley with *F. americana*, *O. virginiana*, *Betula papyrifera* and *Q. rubra*, 10.vi.2016, on *O. virginiana*, *S.R. Brinker 4894* (CANL).

*****Placidium arboreum* (Schw. *ex* Tuck.) Lendemer**

FIGURE 5A

NOTES. – These are the first confirmed reports of this species in Canada. Being the only corticolous *Placidium* (Hinds & Hinds 2007), this distinctive species is easily recognized. However, misidentifications can occurr when it has been found growing over moist, mossy stones and rocks (Hinds & Hinds 2007). All other Ontario species of *Placidium* are terricolous, restricted to calcareous soil. *Placidium arboreum* is widespread in the eastern United States, though not commonly collected (Showman & Flenniken 2004).

Specimens examined. – **CANADA. ONTARIO.** LANARK CO.: Clyde Forks, Ontario, Lanark Highlands area S of Calabogie, growing in rich deciduous forest with calcareous cliffs, 17.viii.2015, on shaded base-rich rock face, *C.J. Lewis 2156* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, SW bay of Ottertrack Lake, S-facing cliff several metres above lake, 18.viii.2016, on metamorphic (greenstone) rock, *S.R. Brinker 5244* (CANL); Quetico Provincial Park, small unnamed lake between Emerald Lake and That Man Lake, S-facing calcareous cliff several metres above water, 20.viii.2016, on exposed metamorphic (greenstone) rock, *S.R. Brinker 5312* (CANL).

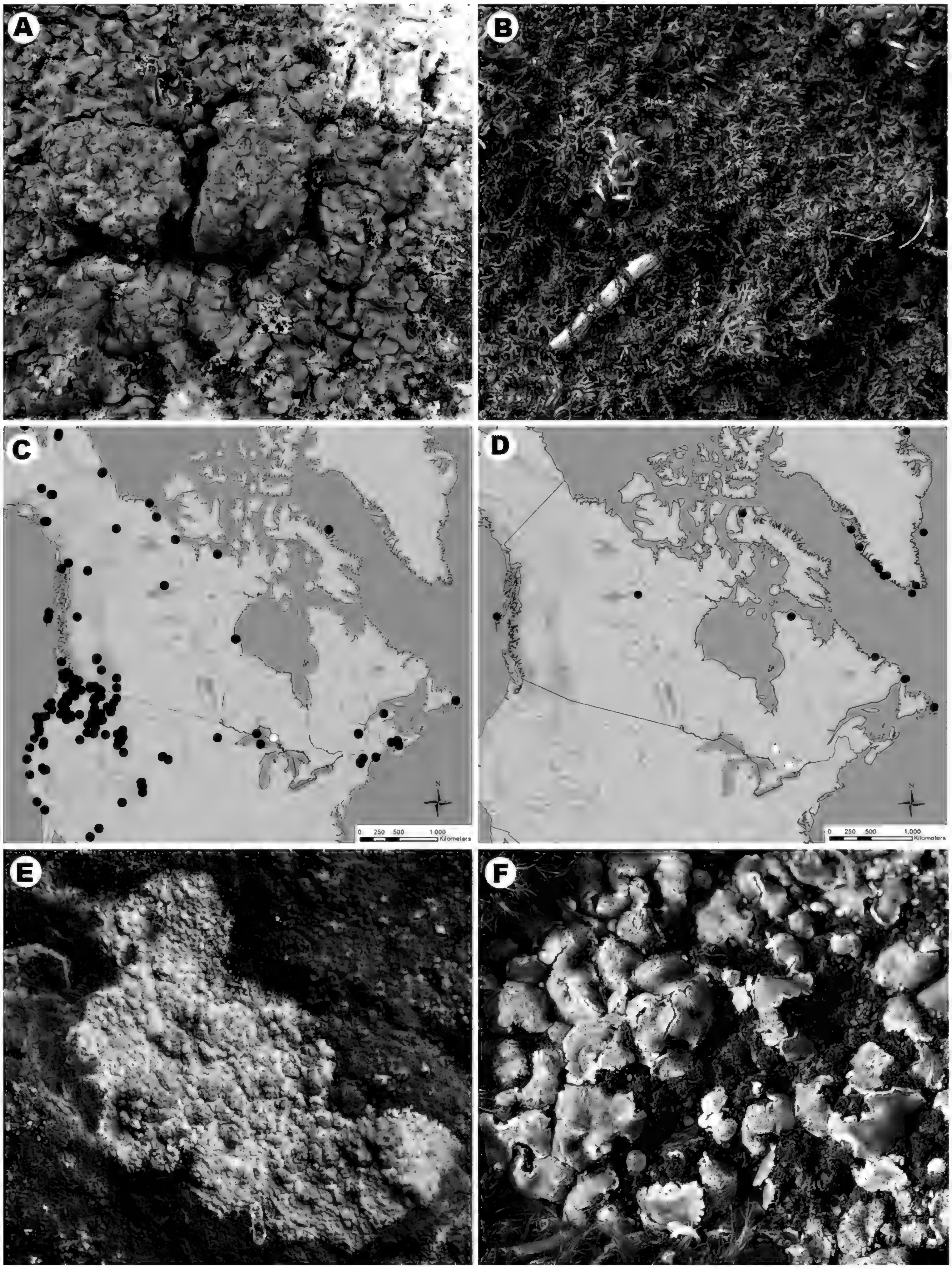

Figure 5. Photographs of species and distribution maps (white = new Ontario records, black = previous collections). **A,** *Placidium arboreum,* on shaded calcareous cliff, Lanark County. **B,** *Polychidium muscicola* among bryophytes cover on sheltered cliff, Michipicoten Island. **C,** distribution of *Polychidium muscicola* in North America. **D,** distribution of *Porpidia melinodes* in North America. **E,** *Psilolechia lucida,* on sheltered cliff, Lake Superior. **F,** Detail of *Psora decipiens*.

***Polychidium muscicola* (Sw.) Gray**

FIGURE 5B

NOTES. – This is the first confirmed report for Ontario and represents the first record of the genus *Polychidium* in the province. *Polychidium muscicola* is typically found on moss over rock and on tree twigs from tropical to subarctic latitudes (Muggia et al. 2011). In North America, it has a mainly western montane and subarctic distribution (Thomson 1984), although disjunct eastern occurrences are known from Maine, New Hampshire and Vermont, where it is considered rare (Hinds & Hinds 2007). This is the first published record from the Great Lakes basin (Figure 5C) and it should be looked for elsewhere in the Lake Superior region on moist, mossy calcareous rock in sheltered situations.

Specimen examined. – **CANADA. ONTARIO.** THUNDER BAY DIST.: Michipicoten Island, East Sand Bay, 7 km E of Quebec Harbour on Lake Superior, SE facing medicolous rock-face above forested talus slope, 31.vii.2015, on rock among bryophyte cover, *S.R. Brinker 4620* (NY; conf. J.C. Lendemer).

***Porpidia melinodes* (Körb.) Gowan & Ahti**

NOTES. – These are the first confirmed reports of this species from Ontario. One was found growing on rock in an old mine slag pile with another metallophyte, *Acarospora sinopica*, and the second is from an exposed rocky shoreline of a small lake on siliceous bedrock with lateral secretions of iron and sulphur precipitate. We suspect its affinity for siliceous rock outcrops rich in heavy metals (Fryday et al. 2009) limits its distribution and abundance in Ontario. It is generally widespread in the boreal-arctic zones of the Northern Hemisphere (Jabłońska 2009), though is currently known from relatively few, widely scattered North American sites (Figure 5D). *Porpidia melinodes* belongs to the *P. speirea* group, and within this group in the *P. flavicunda* subgroup (Buschbom & Mueller 2004). Members of the *flavicunda* subgroup are characterized by orange thalli containing confluentic acid and an I– medulla. *Porpidia melinodes* is rarely fertile, and is distinguished from *P. flavicunda* (Ach.) Gowan by its sorediate thallus.

Specimens examined. – **CANADA. ONTARIO.** NIPISSING DIST.: South Lorrain Township, approximately 19.5 km E of Temagami and 82 km N of North Bay, waste pile of metal-rich rocks beside an old mine in the Cooper Lake/McDonald Creek area, 6.xi.2011, on rock, *C.J. Lewis 953* (NY; det. J.C. Lendemer). HASTINGS CO.: East Tommy Lake, dry, W-facing, exposed siliceous bedrock outcrop with iron and sulphur precipitate along lakeshore above high water mark, 27.iii.2013, on rock, *S.R. Brinker 2815* (NY; det. J.C. Lendemer).

***Protothelenella corrosa* (Körb.) H. Mayrh. & Poelt**

NOTES. – The following collection represents the first report for Ontario. This species was mentioned as an associate growing with other rare species of talus slopes such as *Psilolechia clavulifera* by Lewis (2010). Lendemer et al. (2009) mentioned an unpublished record from Newfoundland and a questionable record from New Brunswick.

Specimen examined. – **CANADA. ONTARIO.** NIPPISING DIST.: South Lorrain Township, approximately 17.5 km E of Temagami and approximately 82 km N of North Bay, underside of rock overhang on a treed talus slope along shore of the Matabichuan River, 28.vi.2008, *C.J. Lewis 164* (CANL).

***Psilolechia lucida* (Ach.) M. Choisy**

FIGURE 5E

NOTES. – These records are the first published accounts since *Psilolechia lucida* was reported new to Ontario by Wong and Brodo (1990). It was subsequently classified as very rare in the province (Wong & Brodo 1992), but our records suggest otherwise. As with many other leprose lichens, *P. lucida* prefers protected sites, typically growing on siliceous bedrock away from direct wetting (Brodo et al. 2001). In Ontario, these sites tend to be talus slopes, cliff faces with under-hangs, or crevices in bedrock where air circulation is good. Given these types of sites are often inaccessible, this species is undoubtedly under-documented.

Specimens examined. – **CANADA. ONTARIO.** NIPPISING DIST.: South Lorrain Township, approximately 17.5 km E of Temagami and 82 km N of North Bay, underside of rock overhang on a treed talus slope along shore of the Matabichuan River, 28.vi.2008, on rock, *C.J. Lewis 167* (CANL); S of Haileybury, Devils Rock/Peak, on talus slope of the W lake shore of Lake Temiskaming, 7.vii.2012, *C.J. Lewis 1182 & S.R. Brinker* (CANL). CITY OF KAWARTHA LAKES: Prairie Smoke Alvar (FON), Lake

Dalrymple Rd., underside of a fence rail beside snowmobile trail, 23.ix.2008, *C.J. Lewis 346* (CANL). HASTINGS CO.: Egan Chutes Provincial Park, 10 km E of Bancroft, E-facing shaded rocky underhang along the York River, 12.ix.2012, on siliceous rock, *S.R. Brinker 2780* (CANL); East Tommy Lake, 21 km ESE of Bancroft, sheltered rocky crevice under scattered canopy of *Pinus resinosa* and *Thuja occidentalis*, 27.iii.2013, on siliceous rock, *S.R. Brinker 2813* (CANL). PETERBOROUGH CO.: Kawartha Highlands Provincial Park, 6.2 km N of Burleigh Falls, 700 metres N of Coon Lake, base of Burleigh Ridge on W-facing underhang of siliceous rock cliff, 26.iv.2013, on siliceous rock, *S.R. Brinker 2283* (CANL). THUNDER BAY DIST.: 450 metres E of Steel River bridge at Highway 17, just S of Canadian Pacific Railway on N-facing shaded rock face near railway tracks, 25.vi.2011, on rock, *S.R. Brinker 2007k* (CANL); N shore of Mortimer Island, Lake Superior in sheltered rocky inlet on humid cliff face, 15.vii.2014, on rock, *S.R. Brinker 3942* (CANL); Sunday Harbour, Patterson Island, Lake Superior on sheltered cliff with large overhang, 16.vii.2014, on volcanic rock, *S.R. Brinker 3981* (CANL); Michipicoten Island, Schafer Bay, Lake Superior, shaded rock face in mixed forest with *Betula papyrifera*, *Abies balsamea*, and *Picea glauca*, 28.vii.2015, on rock, *S.R. Brinker 4528* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, large SE bay of Ottertrack Lake along N shore, 75 km SE of Atikokan, exposed S-facing talus slope below cliff, 17.viii.2016, among shaded crevices of boulders, *S.R. Brinker 5222a* (CANL).

Psora decipiens **(Hedw.) Hoffm.**

FIGURE 5F

NOTES. – According to Timdal (1986), *Psora decipiens* is widely distributed from arctic to temperate regions of North America, though absent from the southeastern United States. Thomson (1997) described it as a circumpolar boreal and temperate species, especially common in arid regions, though it also occurs in the western Canadian arctic such as on Banks Island (*S.R. Brinker 2286c*, CANL). It is terricolous or rarely saxicolous, and its preference for undisturbed, dry, bare calcareous sand or exposed base-rich rock likely reflects its scarcity in the province. Published accounts of suitable habitat in Ontario are from globally rare alvars on the upper Bruce Peninsula (Brodo et al. 2013, Brownell & Riley 2000) and the Carden Plain (CNALH 2015) in Simcoe County. Thomson (1997) mapped one record from the southern portion of the Niagara Escarpment near Niagara, where localized outcrops of dolomitic limestone also occur.

Specimens examined. – **CANADA. ONTARIO.** LENNOX & ADDINGTON CO.: N of Napanee, Fred Brown Rd., open alvar pavement with shallow soil, 20.ix.2016, on soil, *C.J. Lewis 2610* (CANL). OTTAWA-CARLTON CO.: Burntlands Alvar, 3.5 km N of Mississippi Mills centre, open *Sporobolus heterolepis* alvar with scattered *Juniperus virginiana*, 19.ix.2014, on shallow soil over limestone pavement, *S.R. Brinker 4431* (CANL); N side of Barrie Rd., 1.8 km S of Claybank, rare and local in open alvar surrounded by conifer woods, 16.x.2015, on moist limestone pavement, *S.R. Brinker 4751* (CANL); Panmure Alvar, Timmins Road, *J. virginiana* treed alvar with exposed, shallow-soiled limestone bedrock, 5.xi.2015, on soil, *C.J. Lewis 2236a* (CANL). GREY CO.: Allan Park Saugeen Valley Conservation Area lands E of Hanover, in *Thuja* mix open area, SW facing slope, 17.iv.2006, on calcareous sand, *C.J. Lewis AP1a* (CANL; conf. I.M. Brodo), 14.iv2012, *C.J. Lewis 1018* (NY).

Psora globifera **(Ach.) A. Massal.**

NOTES. – *Psora globifera* is a mainly western taxon in North America, generally absent from the Arctic and eastern parts of the United States and Mexico (Timdal 1986). Disjunct occurrences from its main range are known however as far east as New Brunswick, Quebec, and Michigan (Thomson 1997). Published records in Ontario are from Lake Superior northwest of Batchawana in Algoma District, and from Delaute Island in Thunder Bay District (Thomson 1997). *Psora globifera* is mainly saxicolous, found on calcareous rock, but can be terricolous on shallow calcareous soil in rocky fissures in exposed areas (Timdal 1986). We report it from a new region in the province from the Rainy River District, and an additional location in the Thunder Bay District.

Specimens examined. – **CANADA. ONTARIO.** THUNDER BAY DIST.: SW shore of Mortimer Island, S of Mortimer Lake, exposed rocky shoreline above splash zone of Lake Superior, 15.vii.2014, on volcanic (diabase) rock, *S.R. Brinker 3957* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, 74 km SE of Atikokan, NE end of Emerald Lake, lower portion of N-facing shaded cliff under partial canopy of *Thuja occidentalis*, 19.viii.2016, on metamorphic (greenstone) rock, *S.R. Brinker 5266* (CANL).

Psora pseudorussellii **Timdal**

NOTES. – *Psora pseudorussellii* is a saxicolous species of calcareous rock, found mainly in eastern and southern parts of North America from southern Quebec and Ontario, south to Georgia, Texas and northern Mexico (Timdal 1986). It was considered rare in southern Ontario by Wong and Brodo (1992) who reported it new to the province from Hastings and Frontenac counties. It was also recently reported from Awenda Provincial Park in Simcoe County by McMullin and Lendemer (2016). We report it from three additional counties and districts.

Specimens examined. – **CANADA. ONTARIO.** FRONTENAC CO.: Frontenac Provincial Park, 38 km N of Kingston, NW portion of Devil Lake just north of Gibson Lake, rim of south-facing calcareous rocky slope with *Solidago nemoralis*, *Aquilegia canadensis*, and *Juniperus communis*, 26.x.2016, on metamorphic (marble) rockface *S.R. Brinker 5473* (CANL); Devil Lake shoreline NE portion of the park, marble cliff along lake shore, 26.x.2016, on rock, *C.J. Lewis 2733, 2725, 2716* (CANL). LANARK CO.: Lanark Highlands, 1.8 km W of Clyde Forks, 14.5 km S of Barrett Chute, S-facing cliff in rich deciduous forest with marble outcrops, 10.vi.2016, on metamorphic (marble) rock, *S.R. Brinker 4889* (CANL). RENFREW CO.: Mountain Chute Station, Norcan Lake, conifer woods on S-facing slope with *Thuja occidentalis*, *Pinus resinosa* and *Picea glauca*, 9.vi.2016, on shaded vertical metamorphic (marble) rock, *S.R. Brinker 4875* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, NE end of Emerald Lake, S-facing cliff above shore, 19.viii.2016, on exposed vertical metamorphic (greenstone) rock, *S.R. Brinker 5302 & P. Scott* (CANL).

Punctelia appalachensis **(W. L. Culb.) Krog.**

FIGURE 6A

NOTES. – These are additional observations of this rare species in Ontario. The first record was found 40 km northeast in Kinghurst Forest (McMullin & Lewis 2013), a site well known for its phenomenal remnant old-growth upland forest (Larson et al. 1999). Old growth forest conditions were also observed at the Greenock Swamp and Lake Superior Provincial Park locations. Mature to old-growth forests are rare in southern Ontario (Larson et al. 1999), and based on our experience this species is confined to this habitat, which was more widespread prior to European settlement.

Specimens examined. – **CANADA. ONTARIO.** FRONTENAC CO.: Frontenac Provincial Park, Arab Lake Trail, shaded mixed forest, 18.ix.2016, on mossy moist cliff, *C.J. Lewis 2585* (CANL). ALGOMA DIST.: Lake Superior Provincial Park, along the Sand River, 61 km S of Wawa, edge of mixed forest with *Abies balsamea*, *Betula alleghaniensis*, *Acer spicatum*, and *Thuja occidentalis*, 11.vii.2016, on bark of *B. alleghaniensis* and *T. occidentalis*, *S.R. Brinker 4942* (CANL, NY); BRUCE CO.: Greenock Swamp Conservation Area, 10 km NW of Walkerton, Con Rd 6, mature *Acer rubrum-Fraxinus* sp. swamp, 21.xii.2015, on mossy *Acer* sp. trunk, *C.J. Lewis 2272* (CANL).

******Ramalina sinensis*** **Jatta**

FIGURE 6B

NOTES. – These are the first published records of this species from Ontario. It is a broad, fan-shaped species of *Ramalina* which is normally fertile and produces no known vegetative propagules (Brodo et al. 2001). It is considered uncommon in Canada and a Group 3 low-priority candidate species by COSEWIC (2015). It is considered widespread in North America (Brodo et al. 2001), but uncommon in Canada, with the majority of records from the Canadian prairies where it is restricted to dry sandy habitats (Francisco de Oliveira et al. 2012). Our Ontario records extend its Canadian range east into northwestern Ontario where it is rare, restricted to open, humid habitat near bodies of water.

Specimens examined. – **CANADA. ONTARIO.** KENORA DIST.: S shore of Copper Island in Ptarmigan Bay, Lake of the Woods, rich, S-facing open rocky slope, 11.vi.2013, on twigs, *S.R. Brinker 2924 & C.J. Lewis* (CANL). RAINY RIVER DIST.: N side of Rainy River, between Big Fork and Little Fork Rivers, 4 km E of Big Fork hamlet, edge of lowland and floodplain deciduous forest/swamp, 13.vi.2013, on twigs, *S.R. Brinker 2956 & C.J. Lewis* (CANL). THUNDER BAY DIST.: Pigeon River Provincial Park, downstream of Little Falls, edge of mixed open woodland on river levee, 19.vii.2014, on branches of *Populus deltoides*, *S.R. Brinker 4042* (CANL); Aguasabon Gorge, 1 km E of Terrace Bay, open area above falls with scattered mature trees, 24.vii.2016, on *Populus tremuloides*, *S.R. Brinker 5203* (CANL).

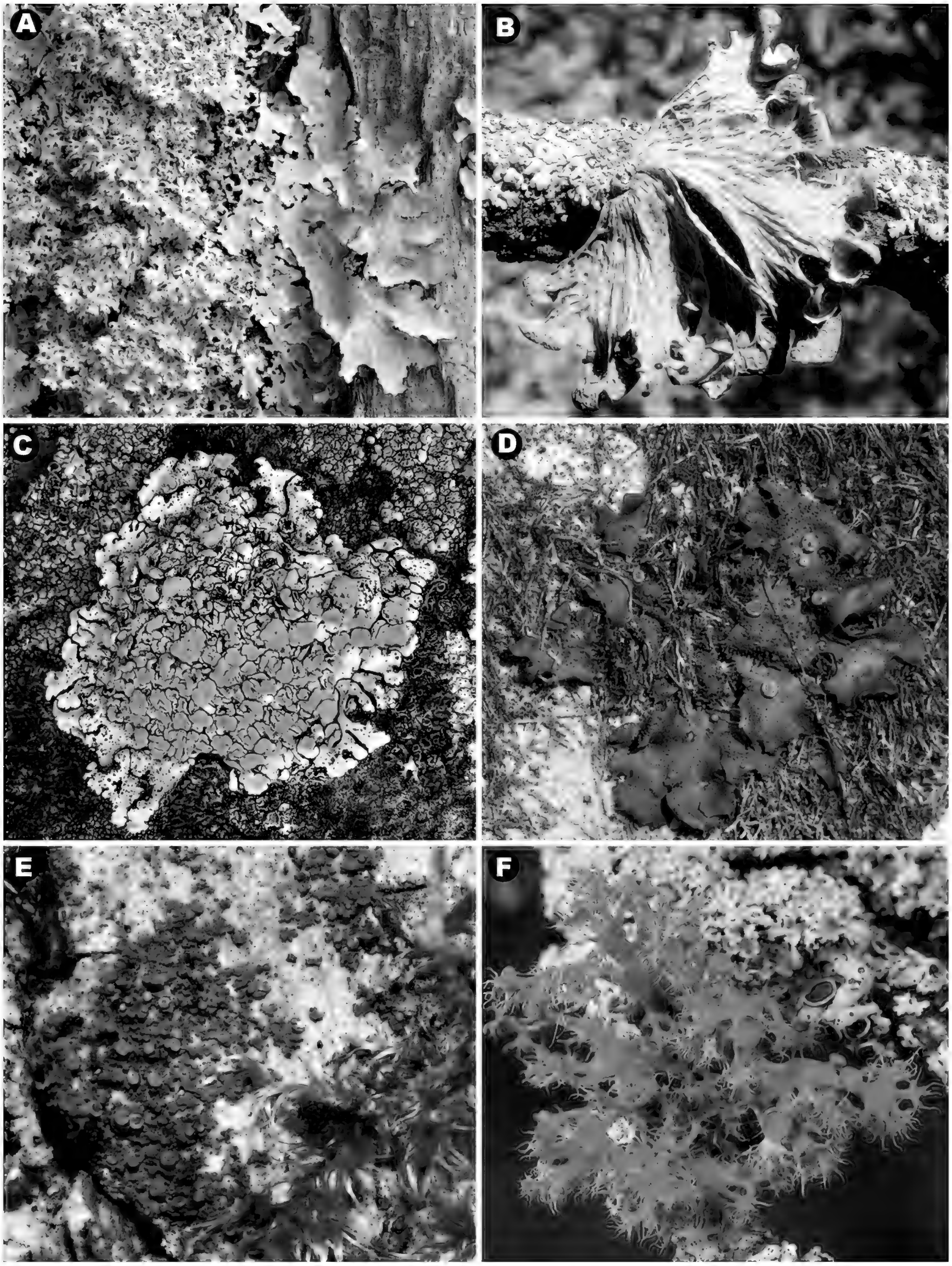

Figure 6. Photographs of selected species. **A,** Detail of *Punctelia appalachensis* on *Thuja occidentalis*, Algoma District. **B,** *Ramalina sinensis* habit, on sunlit twig. **C,** *Rhizoplaca chrysoleuca* habit, on rock, Thunder Bay District. **D,** *Scytinium dactylinum* on limestone boulder. **E,** Detail of *Scytinium subtile*. **F,** *Teloschistes chrysophthalmus,* on sunlit twig, Kenora District.

***Rhizocarpon oederi* (Weber) Körb.**

NOTES. – These records are the first from Ontario for this facultative arctic-alpine species since it was reported new for the province by Wong and Brodo (1990) from Hastings County. *Rhizocarpon oederi* is an edaphically limited species in Ontario, restricted to substrates enriched in certain heavy metals, namely iron (Fletcher et al. 2009b).

Specimens examined. – **CANADA. ONTARIO.** HASTINGS CO.: Bancroft, talus slope/cliff along Hwy 28, at the base of the "Eagles Nest" lookout, 7.v.2009, on rock, *C.J. Lewis 317* (OAC). TEMISKAMING DIST.: S of Haileybury, Devils Rock/Peak, talus slope along the W lake shore of Lake Temiskaming, 7.vii.2012, on rock, *C.J. Lewis 1188 & S.R. Brinker* (CANL). THUNDER BAY DIST.: 2.2 km SW of Moose Hill, Slate River Valley, dry N-facing cliff with sulphur precipitate, 17.vii.2014, on sedimentary (shale) rock, *S.R. Brinker 4032a* (NY; conf. J.C. Lendemer); Castle Creek Provincial Nature Reserve, SW side of Whitefish Lake, 14 km SW of Silver Mountain, moist N-facing cliff with iron oxide staining, 25.viii.2016, on sedimentary (shale) rock, *S.R. Brinker 5414* (CANL).

***Rhizoplaca chrysoleuca* (Sm.) Zopf**

FIGURE 6C

NOTES. – *Rhizoplaca chrysoleuca* has a mainly temperate western and central United States distribution in North America (Brodo et al. 2001) where it is found in open areas on exposed acid or base-rich rock (Thomson 1997). In Ontario, Crowe (1994) listed *R. chrysoleuca* from at least ten locations in the Thunder Bay District mainly from collections made on the Slate Islands in Lake Superior. Other records include three widely scattered occurrences along the north shore of Lake Superior in Algoma District from Old Woman Bay and Orient Bay in Thunder Bay District (CNALH 2015). We report *R. chrysoleuca* from three additional areas including Lake of the Woods, Rainy River District, and Tarp Hill north of Pickle Lake. Records from the Ottawa region of eastern Ontario (Brodo 1981) are based on misidentifications of *R. subdiscrepans*. The easternmost Ontario collection appears to be from Manitoulin Island (*R.F. Cain & A. Henssen 28345,* CANL!).

Specimens examined. – **CANADA. ONTARIO.** KENORA DIST.: Tarp Hill, 17 km N of Pickle Lake, S-facing granitic cliff, 8.viii.2010, on rock, *S.R. Brinker 1904b* (CANL); S shore of Cliff Island, Lake of the Woods, 37 km S of Kenora airfield, S-facing open rocky slope, 10.vi.2013, on rock, *S.R. Brinker 2915* (CANL). THUNDER BAY DIST.: Marathon, 400 m S of Stevens Ave., 80 m S of Canadian Pacific Railway line, rocky headland along Lake Superior coast above high water mark, 24.vi.2012, on large exposed siliceous boulders, *S.R. Brinker 1999* (CANL); S end of Leadman Island, Lake Superior, exposed rocky headland, 17.vii.2014, on siliceous bedrock, *S.R. Brinker 4002* (CANL); Lake Nipigon, Orient Bay, 47 km N of Nipigon, exposed talus below cliff, 15.vii.2016, on volcanic (diabase) rock, *S.R. Brinker 5040* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, SE bay of Ottertrack Lake along north shore, 75 km SE of Atikokan, S-facing talus slope, 17.viii.2016, on exposed boulder, *S.R. Brinker 5219* (CANL); Quetico Provincial Park, N shore of Emerald Lake, 4 km N of Knife Lake, S-facing cliff above high water mark, 20.viii.2016, on vertical metamorphic (greenstone) rock, *S.R. Brinker 5310 & P. Scott* (CANL).

†*Scytinium dactylinum* (Tuck.) Otálora, P. M. Jørg. & Wedin

FIGURE 6D

NOTES. – Until recently, this species was only known in Ontario from a 19th century collection by John Macoun (cited in Sierk 1964 as Leptogium dactylinum Tuck.). It was thought to be extirpated from Canada (Goward et al. 1998), though our records prove otherwise. We have observed that *Scytinium dactylinum* can be locally common in portions of southeastern Ontario in areas with continuous forest cover and undisturbed, shaded, limestone bedrock exposures. We suspect it to be more widespread in this part of the province than current records indicate.

Specimens examined. – **CANADA. ONTARIO.** PETERBOROUGH CO.: 6 km NW of Buckhorn, Ontario, on limestone boulders in an outwash creek of a large vernal pool, 5.ix.2010, on rock, *C.J. Lewis 477* (NY; det. R.C. Harris); Dummer Lake Road, W shore, N of Warsaw, limestone boulders along NE facing limestone ridge, 26.vi.2011, on rock, *C.J. Lewis 607* (NY; det. R.C. Harris); Otonabee Region Conservation Area agreement forest (Oatbox), N of Warsaw, on limestone boulders in shaded forest, 18.vi.2011, *C.J. Lewis 613* (NY; det. R.C. Harris); Ties Mountain Rd., 11.5 km NE of Bobcaygeon, in managed *Acer saccharum - Tilia americana* dominated forest, 14.v.2016, on fractured limestone slabs at base of rock ridge, *S.R. Brinker 4856* (CANL). LANARK CO.: Almonte, along the Mississippi River, growing on top of limestone boulders below waterfall, 24.ii.2011, on rock, *C.J. Lewis 507C* (NY; det. R.C.

Harris); HASTINGS CO.: Deroche Alvar, S of Tweed, in shaded deciduous forest, 7.iv.2011, on limestone boulders, *C.J. Lewis 585* (NY; det. R.C. Harris); 3.86 km E of Stoco, 3 km NW of Larkins, rich deciduous woods, 4.vii.2012, on moist sedimentary (limestone) rock, *S.R. Brinker 2537* (CANL); Rawdon Block, 5 km SE of Marmora, conifer forest with *Thuja occidentalis* and *Abies balsamea*, 13.v.2016, on shaded sedimentary (limestone) boulder, *S.R. Brinker 4846* (CANL); 9.7 km SE of Tweed, 2 km SW of Larkins, second-growth conifer woods with *T. occidentalis* and *Ostrya virginiana*, 13.x.2016, on shaded limestone boulders, *S.R. Brinker 5461* (CANL); 5.5 km ESE of Madoc, 500 metres S of Moira River near its mouth at Moira Lake, second-growth deciduous woods with *Acer saccharum* and *Ostrya virginiana*, 13.x.2016, on shaded limestone boulders, *S.R. Brinker 5467* (CANL). GREY CO.: Inglis Falls Conservation Area, S of Owen Sound, on top of limestone boulders in a shaded valley, 25.ix.2010, on rock, *C.J. Lewis 486* (CANL). OTTAWA-CARLTON CO. Ottawa River, Sixth Line Rd., shaded calcareous cliff along shoreline with NE aspect, 5.xi.2015, on limestone, *C.J. Lewis 2227* (CANL).

***Scytinium subtile* (Schrad.) Otálora, P. M. Jørg. & Wedin**

FIGURE 6E

NOTES. – This species is known from the Ottawa region from a published account in Thomson (1984) under its synonym, *Leptogium minutissium* (Flörke) Fr. Sierk (1964) did not list it for Ontario in his monograph of the genus. The micro-fruticose species in this genus are sometimes easily confused with one another, but this species is relatively easy to recognize because of its raised globose apothecia and stellate spreading lobes (Jørgensen 1994). Due to their small size and cryptic nature, *Scytinium subtile* and *S. teretiusculum* may simply be overlooked, which may be as a result of being hidden for part of the year as it found growing on seasonally inundated trunks of hardwoods.

Specimens examined. – **CANADA. ONTARIO.** CITY OF KAWARTHA LAKES: Balsam Lake Provincial Park, vernal pool, 23.x.2013, on seasonally inundated trunks of *Fraxinus* sp., *C.J. Lewis 1428 & S.R. Brinker* (CANL). HASTINGS CO.: Storms Rd., MRCA Conservation Lands, SE of Marmora, on the banks of the Black River, floodplain, 4.iv.2012, on seasonally inundated trunks of *Fraxinus* sp., *C.J. Lewis 1078 & S.R. Brinker* (CANL). HASTINGS CO.: Cassidy Block, 7 km SE of Stoco Lake, 6.4 km E of Duff's Corners, west of Deroche Rd., edge of seasonally flooded pond with adjoining lowland forest, 16.x.2012, on seasonally inundated trunk of *Acer saccharinum*, *S.R. Brinker 2789* (NY). LANARK CO.: Clyde Forks, 18 km S of Calabogie, in deciduous forest with calcareous cliffs and low lying areas, 17.viii.2015, on seasonally inundated trunks of (*Fraxinus* spp.), *C.J. Lewis 2158 & D. Ferland* (CANL); 22 km S of Calabogie, Hwy 511 off of the French Line, mixed deciduous forest with low-lying areas and high ridges, 10.xii.2015, on seasonally inundated trunks of Fraxinus sp., *C.J. Lewis 2268* (CANL). PETERBOROUGH CO.: S of Quackenbush Provincial Park, 2.0 km S of the intersection of Rd. 6 and Hwy 44, vernal pool, 30.ix.2012, on seasonally inundated trunks of Fraxinus sp., *C.J. Lewis 1417* (CANL).

***Scytinium teretiusculum* (Wallr.) Otálora, P. M. Jørg. & Wedin**

NOTES. – Wong and Brodo (1990, 1992) tentatively identified specimens of this species from several collections from Hastings, Frontenac, Renfrew, and York counties and the Ottawa region. The material here matches the description published by Brodo (2015), and we feel confident in the identification of the material examined. The micro-fruticose members of this genus can be difficult to distinguish from one another, but this species can be recognised by a richly branching thallus with cylindrical isidioid branchlets that are constricted at the point of attachment. Our records were collected among bryophytes on lower tree trunks of moist to seasonally inundated trees. When fertile, which is rare, *Scytinium teretiusculum* has relatively large concave apothecia (Thomson 1984).

Specimens examined. – **CANADA. ONTARIO.** CITY OF KAWARTHA LAKES: Norland, Ontario, dam E of town Monck Rd., Gull River, on mossy trunk of (*Fraxinus* sp.) beside river, 31.iii.2010, *C.J. Lewis 384* (CANL). GREY CO.: Inglis Falls Conservation Area, S of Owen Sound, on the banks of the Sydenham River beside river, 25.ix.2010, on mossy trunk of *Fraxinus* sp., *C.J. Lewis 490* (CANL). HALIBURTON CO.: Little Esson Lake, 33 km W of Bancroft, 3.5 km W of Wilberforce, edge of small deciduous swamp with *Fraxinus nigra* and *Ulmus americana*, 25.v.2016, on seasonally inundated lower trunk of *F. nigra*, *S.R. Brinker 4859* (CANL). HASTINGS CO.: 3.4 km SE of Thomasburg, 400 m W of Moira River, edge of swampy pond and adjoining lowland deciduous forest, 30.iv.2012, on mossy *F. nigra* with *Leptogium rivulare, S.R. Brinker 2491* (CANL); 1 km E of Paudash Lake, roughly 15 km S of Bancroft, edge of vernal pool in valley of mature deciduous forest, 5.iv.2013, on mossy base of *F.nigra, S.R. Brinker 2820* (CANL). NIPPISSNG DIST.: Temagami Lake Access Rd., in mixed deciduous forest, in

low-lying area 24.vi.2012, on base of mossy seasonally flooded *Fraxinus* sp., *C.J. Lewis 1121* (CANL); Rabbit Lake Access., in mixed deciduous forest in low-lying area, 24.vi.2012, on mossy seasonally flooded *Fraxinus* sp., *C.J. Lewis 1122* (CANL). PETERBOROUGH CO.: Back Dam Conservation Area/Park, E of Warsaw along the Indian River, on mossy trunk of *Fraxinus* sp. beside river, 18.viii.2009, *C.J. Lewis 345* (CANL); E of Fraserville on the Otonabee River, growing on mossy trunk (*Acer* sp.) beside river, 20.i.2010, *C.J. Lewis 348* (CANL); Hwy 7 E of Peterborough (Jermyn), on the Indian River, growing on mossy trunk (*Fraxinus* sp.) beside the Indian River, 2.iii.2011, *C.J. Lewis 514* (CANL). SIMCOE CO.: McCrae Point Provincial Park, seasonally flooded pool in deciduous swamp, 23.x.2012, on mossy *Fraxinus* sp. at high water flood line, *C.J. Lewis 1429 & S.R. Brinker* (CANL). THUNDER BAY DIST.: Davieaux Island, E side, S of Michipicoten Island, Lake Superior, exposed rocky shoreline with splash pools, 31.vii.2015, on siliceous bedrock, *S.R. Brinker 4610* (CANL); Pigeon River Provincial Park, 50 km SW of Thunder Bay, 3 km W of Pigeon Bay, Lake Superior, deciduous floodplain woods with *Fraxinus nigra,* 18.vii.2016, on mossy bark at base of large *Salix ×fragilis*, *S.R. Brinker 5103* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, NE end of Emerald Lake, 2 km N of Knife Lake, *Thuja occidentalis* dominated conifer swamp in valley, 21.viii.2016, among bryophytes on bark of *T. occidentalis*, *S.R. Brinker* 5340 (CANL).

***Teloschistes chrysophthalmus* (L.) Th. Fr.**

FIGURE 6F

NOTES. – *Teloschistes chrysophthalmus* was first reported for Ontario by Macoun (1902) on trees and fence-rails along large bodies of water from Lake Ontario in 1868, and later along Lake Erie at Port Rowan in 1892 and Point Pelee in 1901. Other early accounts from the Great Lakes region are from coastal areas of Erie County, Ohio (Claassen 1912), Erie County, New York (Eckel 2013), and Charlevoix County, Michigan (CNALH 2015). A single report from Queen Victoria Park at Niagara Falls also exists in Cameron (1895). These early records suggest *T. chrysophthalmus* was always rare and restricted to coastal areas in the region. Since these early records, no contemporary reports were known in Ontario until it was rediscovered along Lake Ontario at Sandbanks Provincial Park (McMullin & Lewis 2014). Our new records from Lake of the Woods expand its range in the province over 800 kilometers to the northwest (Figure 7A).

Teloschistes chrysophthalmus appears to have declined throughout eastern North America (Brodo et al. 2001, Flenniken 1999, Wilhelm 1998). Its disappearance is most likely the result of habitat destruction and its sensitivity to air pollution (Brodo et al. 2001, Hinds & Hinds 2007). It is considered likely extinct in New York (Harris 2004), listed as critically endangered in Michigan (Fryday & Wetmore 2002), endangered in Ohio (Flenniken & Showman 1990) and of special concern in Wisconsin (Wisconsin Department of Natural Resources 2016). The Great Lakes population in Ontario was most recently designated Endangered in Canada (COSEWIC 2016). It also occurred historically in Connecticut, Massachusetts, Maryland, New Jersey and Rhode Island (CNALH 2015, Hinds & Hinds 2007). Declines have also been noted in western and central Europe (Fletcher and Purvis 2009). It is considered extirpated in Germany (Wirth 2008), Belgium (Diederich et al. 2015), and Switzerland (Scheidegger & Clerc 2002) and was thought extinct in Ireland and Britain but was recently rediscovered (Sanderson 2012, Whelan 2011), probably arriving via long distance spore dispersal following reductions in sulphur dioxide levels in Europe, as with other species (Coppins et al. 2001, Hawksworth & McManus 1989, Rose & Hawksworth 1981, Stapper and Franzen-Reuter 2010). It likely has suffered a similar fate in eastern North America where some of the highest concentrations of air borne pollutants have occurred such as in the Ohio Valley (Flenniken & Showman 1990).

Teloschistes chrysophthalmus is an epiphytic twig and branch specialist (Fletcher and Purvis 2009), but can also be found on tree bark in well-lit situations (Showman & Flenniken 2004). The finely branching fruticose growth-form of *T. chrysophthalmus* results in a large surface area-to-volume ratio, and this is further increased by the presence of minute cilia (Brodo et al. 2001). These features make such lichens more susceptible to atmospheric pollution than other species (Hawksworth and McManus 1989, Hawksworth and Rose 1970).

Specimens examined. – **CANADA. ONTARIO.** KENORA DIST.: 31 km W of Kenora, 700 m N of Hwy 17 on Sherwood Lake Rd, W-facing rocky slope with *Pinus banksiana*, *Picea glauca*, *Populus tremuloides* and *Juniperus communis*, 9.vi.2013, on *P. glauca*, *S.R. Brinker 2896* (CANL); S side of Hwy 11-17 W of Keewatin, just N of Spruce Lake, treed conifer rock barren with *P. banksiana*, *Abies balsamea*, *P. glauca*, *Pinus strobus* and *Juniperus communis*, 9.vi.2013, *S.R. Brinker 2899* (CANL); Lake

of the Woods, unnamed Island off Thompson Island just S of Houghs Island, open rock outcrop on S side of small island, 10.vi.2013, on *Fraxinus pensylvanica*, *S.R. Brinker 2901* (CANL); S side of Skeet Island, Lake of the Woods, 35 km S of Kenora, low vertical sheltered rock face above high water mark along shore, 10.vi.2013, on rock, *S.R. Brinker 2905* (CANL); W side of Bath Island, Lake of the Woods, 26 km S of Kenora, edge of mixed woods along S-facing rocky shoreline, 10.vi.2013, *S.R. Brinker 2921* (CANL); S side of Gull Island, Lake of the Woods, 25 km S of Kenora, edge of mixed rocky woods along S-facing rocky shoreline, *S.R. Brinker 2923a* (CANL); S shore of Copper Island in Ptarmigan Bay, Lake of the Woods, along shoreline under *P. strobus*, 11.vi.2013, on *Fraxinus nigra*, *S.R. Brinker 2933* (CANL); on a promontory of Calm Bay south of Magnet Point, Shoal Lake, 1.5 km from Manitoba border, along dry S-facing rocky prairie-like opening with scattered *Quercus macrocarpa*, 11.vi.2013, on *Thuja occidentalis*, *S.R. Brinker 2936* (CANL); day-use area, 400 m SW of campsites, Sioux Narrows Provincial Park, manicured grassy slope with *Crataegus* spp., 13.vi.2013, on open-grown *P. glauca*, *S.R. Brinker 2959* (CANL).

***Thyrea confusa* (Scop.) Henssen**

FIGURE 7B

NOTES. – *Thyrea confusa* was reported for the first time in Ontario from the Burntlands Alvar in eastern Ontario (Catling 2013). We report eight new locations in the province and extend its Ontario range northwest to the Rainy River District in the Boundary Waters region, and southwest to Haldimand County along Lake Erie (Figure 7C). Two of these locations are from calcareous cliffs, the remainder are from alvars with exposed limestone pavement. LaGreca (2010) recently reported *T. confusa* from similar alvar habitat in the Chaumont Barrens in adjacent New York State. Other recent reports in eastern North America are from moist calcareous rock in Ohio (Showman & Flenniken 2004) and from limestone glades in West Virginia (Townsend 2014). An early 19th century record also exists from Vermont (Hinds & Hinds 2007). Otherwise, *T. confusa* is found at scattered localities throughout North America (Brodo et al. 2001).

Thyrea confusa is a cyanolichen with a distinctive strap-like lobed thallus emanating from a central hold fast attached to calcareous rock; it rarely possesses apothecia which are obscure and immersed in the thallus (Hinds & Hinds 2007). Its shape and dark-brown to black colouration when wet (drying to blue-gray due to pruina) are characteristic. Owing to its restriction to seasonally wet limestone pavement or suitably calcareous moist rock faces, *T. confusa* will likely remain a rare species in the province given the global rarity of alvar habitat highlighted by Brownell and Riley (2000).

Specimens examined. – **CANADA. ONTARIO.** HASTINGS CO: 9.7 km SE of Tweed, 2 km SW of Larkins, open alvar with *Panicum philadelphicum* and *Danthonia spicata*, 13.x.2016, on seasonally flooded limestone pavement and pebbles, *S.R. Brinker 5466* (CANL). KAWARTHA LAKES: North Bear Alvar, 500 m N of Alvar Rd., 3.4 km E of Lake Dalrymple, in moist shallow depressions of limestone pavement in open alvar with *Deschampsia caespitosa*, *Packera paupercula*, *Carex cryptolepis*, *Schizachyrium scoparium*, and *Houstonia longifolia*, 5.vi.2015, on limestone, *S.R. Brinker 4464* (CANL). LENNOX AND ADDINGTON CO.: Roblin Municipal Dump Alvar, 1.5 km SW of Roblin on Roblin Rd., small bryophyte-dominated open alvar surrounded by mixed conifer woods, 20.ix.2016, growing on pebbles and open pavement. *C.J. Lewis 2602* (CANL); MANITOULIN DIST.: Misery Bay Alvar, 26 km SW of Gore Bay, Manitoulin Island, rare around edges of shallow, drying pools of open alvar with *Schizachyrium scoparium*, *D. spicata*, and *Sporobolus heterolepis*, 16.ix.2015, on limestone pavement, *S.R. Brinker 4713* (CANL). RENFREW CO: Claybank Alvar, N side of Barrie Rd., 1.8 km S of Claybank, small bryophyte-dominated open alvar surrounded by conifer woods, 16.x.2015, on moist limestone pavement, *S.R. Brinker 4752* (CANL). LANARK CO: 4.5 km NNE of Almonte, past end of Ramsey Concession Rd. 12 ("Burnt Lands"), ix.2007, on rock, *P. Catling s.n.* (CANL); Burnt Lands Alvar, 3.73 km N of Almonte (1.2 km NW of paved end of Ransay Concession Rd. 12), open alvar with *S. heterolepus* and *P. philadelphicum*, 9.ix.2009, attached to pebbles on ground, *I.M. Brodo 32618A* (CANL); Burnt Lands Alvar, 3.5 km N of Mississippi Mills centre, open *S. heterolepis* alvar with scattered *Juniperus virginiana*, 19.ix.2014, on limestone pavement, *S.R. Brinker 4428* (CANL). HALDIMAND CO: Rocky Point Provincial Park, Rock Point, Lake Erie, rocky shore shelf in full sun just above water level of Lake Erie, 23.ix.2011, on limestone, *J.H. Battaglia 2011-200* (CANL, NY). NIPPISING DIST.: Algonquin Provincial Park, below Barron Canyon walking trail on steep S-facing talus slope and surrounding woods, 10.viii.2010, on rock cliff subject to calcareous leaching, *C.J. Lewis 418* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, 75 km SE of Atikokan, N shore of Emerald Lake, S-facing cliff along shoreline, 19.viii.2016, on vertical metamorphic (greenstone) rock near high water mark, *S.R. Brinker 5303 & P.*

Scott (CANL); Quetico Provincial Park, N shore of Plough Lake, between Emerald and Ottertrack Lakes, S-facing calcareous cliff, 22.viii.2016, on metamorphic (greenstone) rock above high water mark, *S.R. Brinker 5370 & P. Scott* (CANL).

***Toninia sedifolia* (Scop.) Timdal**

FIGURE 7D

NOTES. – Previous published reports of *Toninia sedifolia* in Ontario are from dolomitic limestone outcrops of the upper Bruce Peninsula and Flowerpot Island in Georgian Bay (Brodo et al. 2013). We report it from several additional localities on exposures of intrusive igneous and metamorphic outcrops in northwestern and eastern Ontario. It is otherwise widespread in North America from arctic regions south to the Sonoran Desert and Baja California (Brodo et al. 2001, Nash et al. 2001). *Toninia sedifolia* is mainly terricolous on shallow calcareous soils, often found among bryophytes over limestone bedrock, in rocky fissures, or calcareous parent material (Rosentreter et al. 2007), often as a weak parasite on cyanolichens before becoming free-living once established (Timdal 1991).

Specimens examined. – **CANADA. ONTARIO.** COCHRANE DIST.: Attawapiskat River, Attawapiskat Karst Formation, 64 km W of Attawapiskat Airport along the Attawapiskat River, limestone cliffs and moss covered boulders along the exposed river bank, 13.xii.2012, growing on thins soild over calcareous rock, *C.J. Lewis 1316* (CANL). MANITOULIN DIST.: Manitoulin Island, Taskerville Alvar, 300 m inland of Lake Huron, between Portage Bay and Murphy Harbour, 2.5 km SE of Lorne Lake, open alvar with *Juniperus horizontalis*, *Dasiphora fruticosa*, *Juniperus virginiana* and *Pinus banksiana*, 2.vi.2014, among bryophytes on exposed limestone pavement, *S.R. Brinker 3420* (CANL). RAINY RIVER DIST.: Quetico Provincial Park, S shore of Emerald Lake, 3 km N of Knife Lake, 19.viii.2016, on vertical metamorphic (greenstone) rock, *S.R. Brinker 5278 & P. Scott* (CANL). THUNDER BAY DIST.: S shore of Cavern Lake, 60 km NE of Thunder Bay, shaded cliff, 21.vii.2016, on vertical volcanic (diabase) rock, *S.R. Brinker et al. 5166* (CANL).

***Usnea longissima* Ach.**

FIGURE 7E

NOTES. – *Usnea longissima* is an epiphytic lichen of humid, old-growth conifer-dominated forests and has been regarded as a flagship lichen of "virgin forests" in Fennoscandia (Esseen et al. 1981). It appears to have declined throughout much of its circumboreal range over the last several decades (Keon & Muir 2002), especially in Europe and Scandinavia due in large part to modern forestry practices which have reduced the extent of mature spruce forest (McCune & Geiser 1997). It is considered dispersal-limited as it rarely produces soredia and almost never produces apothecia (Esseen *et al* 1981). In North America, it has an interrupted distribution occurring in coastal and montane forests of the Pacific Northwest, with few, scattered records across the central boreal region, and reappearing in coastal areas in the northeast from Maine to Newfoundland (Figure 7F). In Ontario, we have found that *U. longissima* almost always grows near water, especially coastal areas of Lake Superior and Lake Nipigon, similar to Pittam (1995) in western Oregon who primarily found it hanging over or within 100 meters of water bodies. Crowe (1994) reported it from at least ten locations in Thunder Bay District; we provide additional locations for the region, and our locality from the Trout Lake area is the first for Kenora District.

Specimens examined. – **CANADA. ONTARIO.** THUNDER BAY DIST.: Jackfish Bay, just E of old hamlet of Jackfish on S side of railway tracks, in spruce (*Picea* spp.) dominated woods along Lake Superior, 26.vi.2012, on conifer twigs, *S.R. Brinker 2008r* (CANL); Slate Islands Provincial Park, SW side of Mortimer Island, Lake Superior, edge of mixed woods, 15.vii.2014, on twigs of *Picea glauca*, *S.R. Brinker 3956* (CANL); Gardner Lake Trail, Sleeping Giant Provincial Park, in *Thuja-Picea-Betula* mixed woods, 21.vii.2014, on twigs of *P. glauca*, *S.R. Brinker 4097* (CANL), *S.R. Brinker 4099* (CANL); Pijitawabik Palisades, 14 km S of Macdiarmid, edge of open mixed *P.glauca - Betula papyrifera* forest, 2.viii.2015, on twigs of *P. glauca*, *S.R. Brinker 4652* (CANL); Lake Nipigon, SE side of Shakespeare Island, open mixed boreal forest with *B. papyrifera*, *Abies balsamea*, and *Thuja occidentalis*, 13.vii.2016, on conifer twigs, *S.R. Brinker 4978* (CANL); Albert Lake Mesa Conservation Reserve, 53 km E of Nipigon, 23 km SW of Black Sturgeon Lake, mixed boreal forest with *B.papyrifera*, *Picea mariana*, *A. balsamea*, and *Acer spicatum*, 16.vii.2016, on *P. mariana* twigs, *S.R. Brinker 5056* (CANL). KENORA DIST.: Trout Lake Ice Contact area of interest, 1.5 km S of Troutfly Lake, 150 km N of Lake Nipigon, in humid shaded mixed forest (NE aspect) along lake shore, 21.vii.2013, on *Picea* sp., *C.J. Lewis 1743* (CANL).

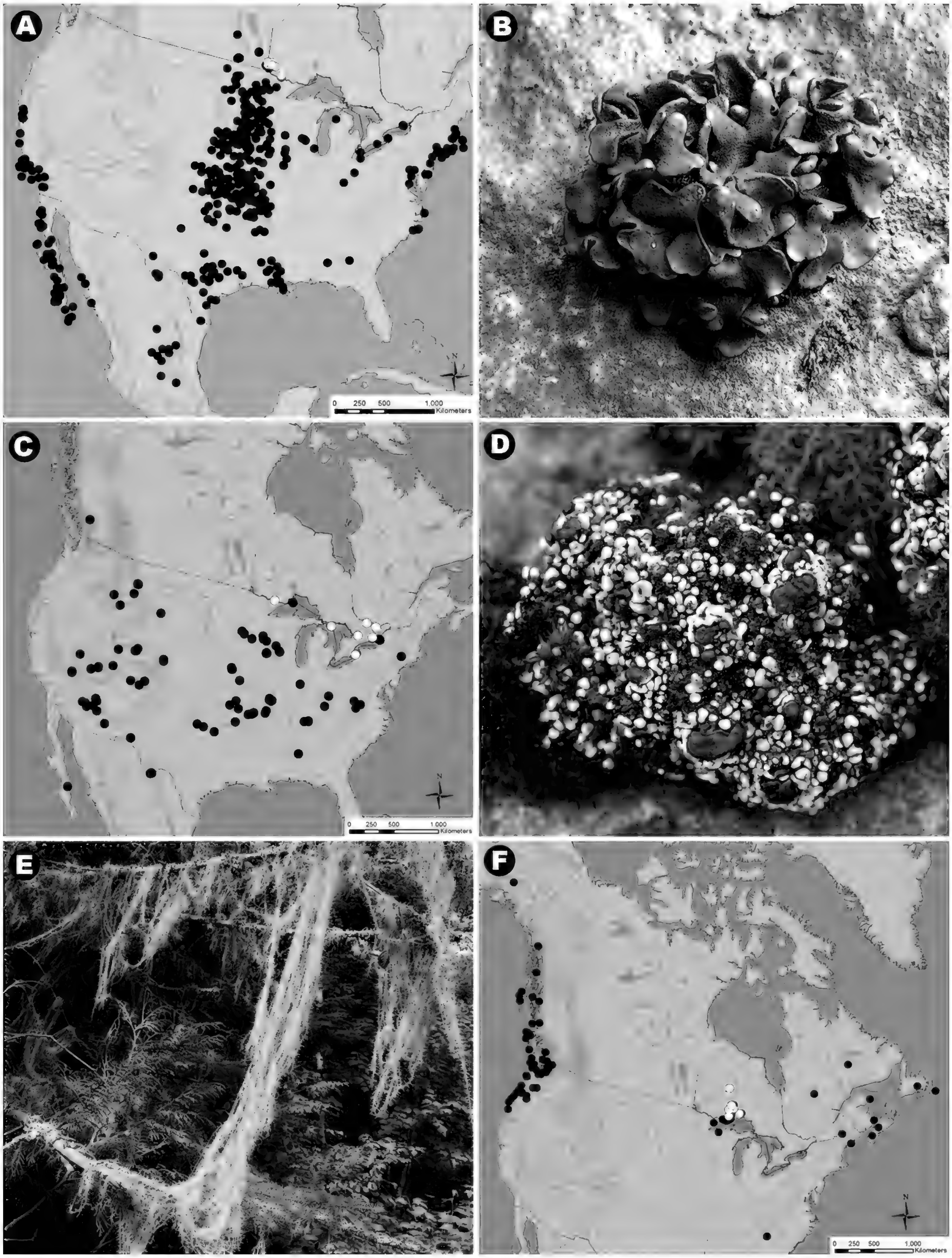

Figure 7. Photographs of species and distribution maps (white = new Ontario records, black = previous collections). **A,** distribution of *Teloschistes chrysophthalmus* in North America. **B,** *Thyrea confusa* (moist), on limestone, Renfrew County. **C,** distribution of *Thyrea confusa* in North America. **D,** *Toninia sedifolia,* among bryophytes over limestone pavement, Manitoulin District. **E,** *Usnea longissima,* on sunlit *Thuja occidentalis* twigs, Thunder Bay District. **F,** distribution of *Usnea longissima* in North America.

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A revision of lichenicolous fungi growing on *Cladonia*, mainly from the Northern Hemisphere, with a worldwide key to the known species

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ABSTRACT. – The paper documents 70 species of fungi found on species of the lichen genus *Cladonia*, 65 of which are obligately lichenicolous. One genus, *Brackelia*, and seven species, *Biciliopsis cladoniae*, *Brackelia lunkei*, *Caeruleoconidia biazrovii*, *Neolamya ahtii*, *Niesslia keissleri*, *Sclerococcum crassitunicatum* and *S. epicladonia*, are here described as new to science. The names *Caeruleoconidia* and *C. ochrolechiae* are validated. *Ameroconium cladoniae* is considered as a heterotypic synonym of *Taeniolella beschiana*. *Merismatium cladoniicola* most likely is a heterotypic synonym of *M. decolorans*. Taxonomic notes on critical specimens, including those of *Abrothallus* cf. *pezizicola*, *Arthonia* cf. *lepidophila*, *Cladophialophora* cf. *cladoniae*, *Hainesia* cf. *bryonorae*, *Merismatium* cf. *nigritellum* as well as of unidentified species of *Acremonium*, *Dactylospora*, *Leptosphaeria*, *Lichenopeltella* and *Pronectria* found on *Cladonia* are provided. *Cercidospora cladoniicola*, *Didymocyrtis cladoniicola*, *Hainesia longicladoniae*, *Pezizella ucrainica*, *Plectocarpon cladoniae* and *Polycoccum laursenii* are documented as new to Asia. *Biazrovia stereocaulicola*, *Hainesia longicladoniae* and *Polycoccum microcarpum* are new to North America. The following species are new to various countries: Argentina (*Bachmanniomyces uncialicola* and *Niesslia cladoniicola*), Finland (*Didymocyrtis foliaceiphila* and *Roselliniella cladoniae*), Japan (*Lichenosticta alcicorniaria*), Lithuania (*Abrothallus* cf. *pezizicola*), Mongolia (*Arthonia digitatae*, *Didymocyrtis cladoniicola*, *Epicladonia stenospora* s. lat., *Lichenostigma alpinum* s. lat., *Phaeopyxis punctum*, *Sphaerellothecium cladoniicola* and *Taeniolella beschiana*), New Zealand (*Abrothallus cladoniae* s. lat. and *Epicladonia sandstedei*), Norway (*Arthonia digitatae*), Kazakhstan (*Sphaerellothecium cladoniae*), Kyrgyzstan (*Epicladonia sandstedei*), Papua New Guinea (*Opegrapha cladoniicola*), Portugal (*Epicladonia stenospora* s. lat.), Russia (*Abrothallus cladoniae* s. lat., *A.* cf. *pezizicola*, *Arthrorhaphis aeruginosa*, *Didymocyrtis foliaceiphila*, *Hainesia longicladoniae*, *Neoburgoa freyi*, *Pezizella ucrainica* and *Polycoccum laursenii*), Spain (*Lichenoconium aeruginosum*), U.S.A. (*Biazrovia stereocaulicola*, *Hainesia longicladoniae*, *Niesslia cladoniicola* and *Polycoccum microcarpum*), Venezuela (*Roselliniella cladoniae*) and Vietnam (*Pyrenidium actinellum* s. lat.). *Epicladonia sandstedei* and *E. stenospora* s. lat. are new to Macaronesia. *Heterocephalacria bachmannii* is for the first time documented in the polar desert biome. *Biazrovia stereocaulicola*, *Coniochaeta* sp., *Merismatium coccisporum* and *Pyrenidium actinellum* s. lat. are newly reported to occur on *Cladonia*. A key to 138 species of fungi so far known to occur on *Cladonia* is provided.

KEYWORDS. – Cladoniicolous fungi, new taxa, new records, new host lichens, taxonomy.

INTRODUCTION

Cladonia (Cladoniaceae) is a subcosmopolitan genus of macrolichens characterized by a dimorphic thallus, formed by a crustose or squamulose primary thallus that is sometimes evanescent, and fruticose podetia (Ahti & Stenroos 2013). It currently comprises 470 species (T. Ahti, pers. comm., 2016)

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and, along with *Arthonia*, *Lecanora*, *Pertusaria* and *Xanthoparmelia*, belongs to the five largest lichen genera in terms of species numbers (Lücking et al. 2016). The species of *Cladonia* mostly grow on soil, but also occur on tree bases and decaying wood, and play an important role in the ground vegetation of tundra and boreal forest vegetation biomes (Ahti & Oksanen 1990). They also frequently occur in many temperate and even tropical habitats (Ahti 2000).

Zhurbenko and Alstrup (2004) provided a key to 77 species of lichenicolous fungi that occurred on *Cladonia*. Subsequently, 25 further species of fungi have been reported from this host lichen genus, viz. *Ameroconium cladoniae* U. Braun & Zhurb. (Zhurbenko & Braun 2013), *Arthonia coniocraeae* Brackel (Brackel 2010b), *A. coronata* Etayo (Coppins & Aptroot 2009), *A. rangiformicola* Brackel & Etayo (Brackel 2015), *Calongeomyces gibelluloides* (D. Hawksw. & Etayo) D. Hawksw. & Etayo (Hawksworth & Etayo 2010), *Cladophialophora cladoniae* (Diederich) Diederich (Diederich 2010), *Dacampia cladoniicola* Halici & A.O. Türk (Halici et al. 2008), *Didymocyrtis cladoniicola* (Diederich, Kocourk. & Etayo) Ertz & Diederich, *D. foliaceiphila* (Diederich, Kocourk. & Etayo) Ertz & Diederich (both Diederich et al. 2007), *Endophragmiella stordeuriana* U. Braun, Zhurb., Diederich, Tsurykau & Heuchert (Zhurbenko et al. 2015b), *Galloea cladoniicola* Alstrup & Søchting (Alstrup & Søchting 2009), *Hainesia brevicladoniae* Diederich & Van den Boom, *H. longicladoniae* Diederich & Van den Boom (both Diederich & Van den Boom 2013), *Lichenoconium aeruginosum* Diederich, M. Brand, Van den Boom & Lawrey (Lawrey et al. 2011), *Lichenopeltella rangiferinae* Brackel (Brackel 2011), *L. uncialicola* Brackel (Brackel 2010a), *Micarea kemmleri* Brackel (Brackel 2016), *Nectriopsis cariosae* Brackel & D.G. Zimmermann (Brackel & Zimmermann 2012), *Neoburgoa freyi* Diederich, Zimmermann & Lawrey (Lawrey et al. 2016), *Phoma grumantiana* Zhurb. & Diederich (Diederich et al. 2007), *Pronectria minuta* Motiej. & Kukwa (Motiejūnaitė & Kukwa 2008), *Ramichloridium cladoniicola* U. Braun & Heuchert (Braun et al. 2009), *Stigmidium cladoniicola* Zhurb. & Diederich (Zhurbenko & Diederich 2008), *S. subcladoniicola* Van den Boom (Van den Boom 2016) and *Syspastospora cladoniae* Etayo (Etayo 2008).

The aims of the paper are to 1) provide new information on the taxonomy, geographic distribution and host preferences of fungi that occur on *Cladonia*; 2) describe a new genus and seven new species of cladoniicolous fungi; and 3) present an updated worlwide key to the species of lichenicolous fungi that occur on *Cladonia.*

MATERIALS AND METHODS

The study is based on 747 examined specimens of fungi (including some lichenized ones) growing on *Cladonia* housed in the herbaria LE (667 specimens) and H (80 specimens), with two duplicates in herb. Diederich. Of these 727 were collected in the Northern Hemisphere (including 389 specimens collected by M. P. Zhurbenko and 26 by R. Pino-Bodas) and 21 were from the Southern Hemisphere. Within the Northern Hemisphere, 622 specimens were from the arctic and boreal forest (taiga) biomes, and 105 represented more southern biomes. The material was examined and photographed using a Stemi 2000−CS dissecting microscope and Axio Imager A1 compound microscope equipped with Nomarski differential interference contrast optics. Microscopic examination was carried out in water, 10% KOH (K), Lugol's iodine, directly (I) or after 10% KOH pre-treatment (K/I), Brilliant Cresyl blue (BCr), lactic acid, nitric acid (N), Phloxine B or Phloxine B after 10% KOH pre-treatment. Measurements were taken from water mounts, unless otherwise indicated. When ten or more measurements are summarized in the text, they are indicated as (minimum–){X −SD}−{X +SD}(–maximum), where X is the arithmetic mean and SD the corresponding standard deviation, followed by the number of measurements. The length/breadth ratios of ascospores and conidia are indicated as l/b and given in the same way.

The DNA of *Coniochaeta* sp. was extracted using E.Z.N.A.® Forensic DNA Kit (OMEGA) according to the manufacturer's instructions. The ITS rDNA region was amplified with the primers ITS1F (Gardes and Bruns 1993) and ITS4 (White et al. 1990). The PCR was done with Ready-to-Go-PCR Beads (GE Healthcare Life Sciences, Little Chalfont, UK), using 3 µl of DNA extracted. The PCR program was described in Pino-Bodas et al. (2013). The PCR product was purified with Illustra GFX PCR DNA and Gel Band Purification Kit (GE Healthcare) and the sequencing was performed at Macrogen Europe (www.macrogen.com). A BLASTn search (Altschul et al. 1997) was used to compare the ITS rDNA sequence with the sequences in the GenBank.

CATALOGUE OF THE STUDIED TAXA

Some lichenized or not truly lichenicolous fungi occurring on *Cladonia* are also included here even though they are not obligately lichenicolous. The cited specimens are organized geographically, first for the Northern Hemisphere (starting with Europe), then for the Southern Hemisphere. Descriptions and occasional taxonomic observations are provided for the insufficiently known or critical taxa or for the deviating or insufficiently known characters of the well-known species.

***Abrothallus cladoniae* R. Sant. & D. Hawksw. s. lat.**

DESCRIPTION. – *Apothecia* convex and often somewhat applanate above, sessile, constricted at the base, stipe not observed, 125–375 µm in diameter, black, matt, distinct pruina not seen. *Epihymenium* medium to dark greenish to olive, sometimes with yellow orange crystals (in *Stenroos 5782a*) or indistinct (in LE 308478). *Hymenium* 30–40 µm tall (including epihymenium), light to medium greenish olive brown, sometimes with purple stripes (in *Stenroos 5782a*) or medium purplish brown (in LE 308478), K+ intensively green (in LE 308478) or just becoming slightly paler and more olive with K (in *Stenroos 5782a*). *Hypothecium* medium brown, up to 100 µm tall basally and up to 30 µm thick laterally. *Asci* narrowly clavate, (40.4–)42.9–49.6(–56) × (6.6–)7.0–8.4(–9.0) µm (n = 23, in K/I), 8-spored. *Ascospores* first light, then medium brown, subellipsoid to short clavate/soleiform, (0–)1-septate, upper cell slightly wider and of more or less the same length as the lower one, constricted at the septum, quite often splitting into semi-spores even in the asci, (7.0–)7.6–9.0(–9.7) × (2.9–)3.2–3.6(–3.8) µm, l/b = (2.0–)2.3–2.7(–2.9) (n = 34; LE 308478) or (5.5–)6.2–7.4(–8.5) × (2.5–)2.6–3.2(–3.6) µm, l/b = 2.1–2.5(–2.7) (n = 42, in water or K; *Stenroos 5782a*), smooth to distinctly verruculose when old. Pathogenicity not observed.

NOTES. – The examined material was quite variable in the pigmentation of the epihymenium and hymenium, reaction with K and in the size of the ascospores. It is noteworthy, that according to the observations of A. Suija (pers. comm., 2015) the K reaction can vary in this species from positive to negative in different ascomata within the same specimen. In the species protologue (Hawksworth 1990) its apothecia were reported as being initially densely green pruinose and often short stipitate, the color of the hymenium and its reaction with K were not indicated, asci were reported to be shorter (28–35 × 7.5–9 µm), and a wider ranger was reported for the size of the ascospores (7–11 × 3–4.5 µm).

Here we report the second record of this species from Asia after Kocakaya et al. (2016). It is also newly reported for Russia and New Zealand. *Cladonia gracilis* ssp. *vulnerata* and *C. neozelandica* are new host taxa.

Specimens examined. – **RUSSIA. CHUKOTKA AUTONOMOUS AREA:** Vesnovannaya River, 65°20'N, 174°26'E, 8.vi.1950, on *Cladonia gracilis* ssp. *vulnerata* (darkened bases of podetia), *M.N. Avramchik s.n.* (LE 308478). **NEW ZEALAND. SOUTH ISLAND:** Fiordland National Park, 45.442°S, 167.688°E, 7.v.2010, on *C. neozelandica* (upper parts of podetia and apothecia), *S. Stenroos 5782a* (H).

***Abrothallus* cf. *pezizicola* Diederich & R.C. Harris**

DESCRIPTION. – *Apothecia* convex and often somewhat applanate above, sessile, constricted at the base, rarely substipitate, 100–350 µm in diameter, black, matt, occasionally with yellowish green pruina. *Epihymenium* medium olive brown, green, blue-green and/or purple, with yellowish or reddish orange crystals. *Hymenium* colorless or sometimes with purple patches (in *Högnabba* 220911-15b), ca. 40 µm tall (including epihymenium), K+ intensively green or blue green. *Hypothecium* medium olive brown basally and partly purple, with red orange crystals laterally, becoming more olive in K. *Asci* narrowly clavate to subcylindrical, 29–41 × 6–10 µm (n = 9), 8-spored. *Ascospores* light to medium brown, clavate, 1-septate, upper cell usually much broader and up to 2.5 times longer than the lower one, occasionally splitting into semi-spores, but this was not observed within the asci, occasionally slightly constricted at the septum, (7.9–)8.8–10.4(–11.5) × (2.5–)3.0–3.6(–4.1) µm, l/b = (2.2–)2.6–3.4(–4.6) (n = 89, in water or K), distinctly verrucose.

NOTES. – There are some discrepancies between the examined material and the protologue (Diederich 2003) where the ascomata were reported as being smaller (up to 220 µm in diameter), the epihymenium dark olivaceous green to almost blackish, the hymenium yellowish-brown, 30–35 µm tall (including epihymenium) and K–, the hypothecium reddish to olivaceous brown and K–, the asci much

shorter (17–19 × 5.5–7.5 µm), and ascospores light brown, often indistinctly verruculose and somewhat smaller (6.5–9.0 × 2.0–3.0 µm). The species is here reported new to Lithuania and Russia. *Cladonia fimbriata* and *C. pyxidata* are new host species.

Specimens examined. – **LITHUANIA:** Asveja Regional Park, 55.073°N, 25.419°E, 22.ix.2011, on *Cladonia fimbriata* (apothecia), *F. Högnabba 220911-15b* (H). **RUSSIA. REPUBLIC OF BURYATIA:** Malyi Bugatai River, 51°52'N, 102°21'E, elev. 750 m, 10.vi.2005, on *C. pyxidata* (podetia), *M.P. Zhurbenko 5129* (LE 309154).

***Acremonium* sp. 1**

NOTES. – Compared to the *Acremonium* species formerly documented on lichens, the examined specimen is most similar to *A. bavaricum* Brackel, reported from *Melanelixia glabratula* (Brackel et al. 2012). However, according to W. von Brackel (pers. comm., 2015) it is not conspecific with that species. The conidiogenous cells are 27–46 µm long, 1.3–1.6 µm wide at the apex, 2.8–3.3 µm wide at the base. The conidia are oblong, sometimes slightly constricted in the middle, rounded at the apices, truncated at the bases, aseptate, and (4.2–)4.6–5.6(–6.6) × 2.0–2.4(–2.8) µm in size [l/b = (1.9–)2.1–2.5(–2.8) (n = 22)].

Specimen examined. – **RUSSIA. CHUKOTKA AUTONOMOUS AREA:** Baranikha, 68°30'N, 168°16'E, 21.vi.1971, on *Cladonia amaurocraea* (somewhat darkened portions of podetia), *I.I. Makarova s.n.* (LE 308481).

***Acremonium* sp. 2**

NOTES. – The material examined is reminiscent of *Acremonium lichenicola* W. Gams, which differs in having subcylindrical, 0–1-septate, somewhat thinner conidia [5–9.5 × 1.5–2(–2.5) µm, l/b = 3–4.4; Hawksworth 1979]. In our material the conidiogenous cells are 41–49 µm long and approximately 3 µm wide at the base. The conidia are hyaline, oblong to subcylindrical, sometimes slightly wider below or constricted in the middle, rounded at the apices, truncated at the base, aseptate, and (7.0–)7.1–7.9(–8.3) × (2.4–)2.5–2.9 µm in size [l/b = 2.6–3.0(–3.1) (n = 13)], often with 2–3 large guttules.

Specimen examined. – **RUSSIA. KRASNODAR TERRITORY:** Caucasus, Lagonaki Upland, Mt. Fisht, 43°57'46"N, 39°55'36"E, elev. 1600 m, 23.viii.2014, on *Cladonia pocillum* (darkened parts of basal squamules), *M.P. Zhurbenko 14276* (LE 308607).

***Anzina carneonivea* (Anzi) Scheid.**

NOTES. – This is a lichen with a rather inconspicuous thallus occasionally found on macrolichens from the genera *Cladonia*, *Peltigera* and *Stereocaulon* (Hafellner 2000, Zhurbenko 2010a). The specimen cited below was formerly erroneously identified and published as *Lettauia cladoniicola* (Zhurbenko 2009a).

Specimen examined. – **U.S.A. ALASKA:** Denali National Park and Preserve, headwaters of Hinnes Creek, 63°43'N, 149°07'W, elev. 900 m, 30.viii.2000, on *Cladonia stygia* (moribund podetia), *M.P. Zhurbenko 00304b* (LE 309147b)

***Arthonia coronata* Etayo**

DESCRIPTION. – *Ascomata* blackish, matt, rough and aggregated in groups. *Hymenium* covered by medium to dark brown, aseptate, cylindrical to somewhat acuminate hairs with acute and sometimes attenuated apices, 9–37 × 3.3–4.7 µm. *Ascospores* hyaline to occasionally light brown, (9.3–)10.7–13.3(–15.0) × (3.9–)4.1–4.9(–6.3) µm, l/b = (1.7–)2.4–3.0(–3.3) (n = 76, in water, K or K/I).

NOTES. – Found on podetia (mainly on their tips) of *Cladonia cornuta*, *C. cyanipes*, *C. deformis* and an unidentified *Cladonia* species. It sometimes causes light bleaching of the host tissues. Formerly known in the United States from Maine and in Canada from Quebec (Lendemer & Harris 2012), its range in North America is here extended to Alaska. *Cladonia cornuta*, *C. cyanipes* and *C. deformis* are new host species.

Specimens examined. – **U.S.A. ALASKA:** Goldstream Valley, 64°57.188'N, 147°42.775'W, 31.vii.2004, on *Cladonia deformis* (upper parts of podetia), *M.P. Zhurbenko 0458* (LE 309141); on *C. cyanipes* (tips of podetia), *M.P. Zhurbenko 0467a* (LE 309140a); Kenai Peninsula, Chugach National Forest, 60°10'N, 149°30'W, elev. 150 m, 1.ix.2000, on *C. cornuta* (podetia), *M.P. Zhurbenko 00478a* (LE 309142a). **CANADA. BRITISH COLUMBIA:** Columbia River Valley near mouth of Mica Creek, 23.vii.2002, on *Cladonia* sp. (upper parts of podetia), *M.P. Zhurbenko 02407* (LE 308779).

***Arthonia digitatae* Hafellner**

DESCRIPTION. – *Apothecia* black, sometimes with brown cast when moistened, epruinose, glossy, convex to applanate, irregularly rounded or elongated in surface view, 70−330 µm lengthways, dispersed to aggregated, sometimes adjacent to confluent. *Epihymenium* distinct, medium to dark brown or brownish orange, sometimes with scattered granules, 5−10 µm tall, becoming pure brown or acquiring gray or olive tint in K. *Hymenium* hyaline to light brown, brownish gray or olive gray, sometimes with scattered granules, 25−45 µm tall, I+ red, K/I+ blue, becoming slightly discolored in K. *Subhymenium* distinct, light to medium brown or brownish orange, 15−50 µm tall, becoming slightly discolored in K. *Paraphysoids* 1.5−3 µm wide, flexuous, branched; tips usually thickened to capitate, 2−6 µm in diameter, sometimes with a distinct dark brown cap (in LE 207410, LE 260947, LE 308503). *Asci* broadly clavate, (23–)30–40(–47) × (10–)13–17(–18) µm (n = 36, in water, K or I), with K/I+ blue ring in the tholus, 8-spored. *Ascospores* consistently hyaline, narrowly clavate, 1-septate, not or rarely slightly constricted at the septum, upper cell wider and occasionally shorther than the lower one (length ratio up to 2:3), (8.2–)10.2–12.8(–16.7) × (3.5)4.1–4.9(–6.6) µm, l/b = (1.7–)2.3–2.9(–3.7) (n = 367, in water, K or K/I), smooth-walled, sometimes with a halo 0.5–1 µm thick.

NOTES. – There are some discrepancies between our material and the protologue (Hafellner 1999), where ascomata were reported as being 0.1–0.2 mm in diameter, asci 20−25 × 12−15 µm, ascospores 9−11 × 3−4.5 µm, without a distinct halo, and the subhymenium hyaline to light brown. The examined material was quite variable, particularly with respect to the pigmentation of different ascomatal parts, and thus almost includes the concept of *Arthonia rangiformicola*, a species so far known from a few finds on *Cladonia rangiformis* in Italy and Spain (Brackel 2015). However, according to observations of W. von Brackel (pers. comm., 2016), the latter species is macroscopically distinct from *A. digitatae* by its scattered ascomata with slightly constricted bases associated with bleached parts of the host thallus.

We found *Arthonia digitatae* on *Cladonia arbuscula*, *C. borealis*, *C. cariosa*, *C. chlorophaea* s. lat., *C. coccifera*, *C. cyanipes*, *C. deformis*, *C. digitata*, *C. foliacea*, *C. furcata*, *C. gracilis*, *C. macroceras*, *C. pleurota*, *C. pyxidata*, *C. stricta*, *C. subcervicornis*, *C. subulata*, *C. symphycarpa*, *C. trassii*, *C. verticillata*, *C. umbricola*, *C. uncialis* and unidentified *Cladonia* species. It mainly occurs on healthy-looking or moribund podetia (sometimes being restricted to their tips), but also occasionally on basal squamules. Heavy infections cause bleaching of the host tissues. Formerly the species was known in Asian Russia only from Trans-Baikal Territory (Zhurbenko et al. 2016), but it is widely distributed in the Holarctic including the polar desert biome. Here we report the species as new to Norway (Svalbard) and Mongolia. *Cladonia arbuscula*, *C. cariosa*, *C. chlorophaea* s. lat., *C. cyanipes*, *C. deformis*, *C. furcata*, *C. gracilis*, *C. macroceras*, *C. pyxidata*, *C. stricta*, *C. subcervicornis*, *C. symphycarpa*, *C. trassii*, *C. verticillata*, *C. umbricola* and *C. uncialis* are new host species. It should be noted that one collection cited below (*Zhurbenko 03451*, LE 260947) was formerly reported as *Arthonia* sp. 1 by Zhurbenko and Brackel (2013). Likewise another (*Lukicheva s.n.*, LE 308513a) was reported as *Arthonia* cf. *epicladonia* by Zhurbenko and Alstrup (2004).

Specimens examined. – **SPAIN. SORIA:** Abejar, 41º46'34"N, 2º46'6"W, elev. 1150 m, 7.vii.2014, on *Cladonia foliacea* (basal squamules), *R. Pino-Bodas s.n.* (H). **NORWAY. SVALBARD:** Aldegondabreen glacier, 78º00'N, 14º12'E, elev. 100 m, 16.vii.2003, on *C. trassii* (moribund podetia), *M.P. Zhurbenko 03451* (LE 260947), on *C. subcervicornis* (moribund bleached podetia), *M.P. Zhurbenko 03212* (LE 308503). **RUSSIA. REPUBLIC OF ADYGEYA:** Caucasus, Mt. Ekspeditsiya, 43°54'48"N, 40°15'43"E, elev. 1950 m, 9.viii.2014, on *C.* cf. *pyxidata* (basal squamules, occasionally podetia), *M.P. Zhurbenko 14273* (LE 308604). **TYUMEN' REGION:** Yamal Peninsula, Saletayakha River, 69°45'N, 68°40'E, 9.viii.1990, on *C. coccifera* (podetia), *O.V. Rebristaya s.n.* (LE 308819). **KRASNOYARSK TERRITORY:** Severnaya Zemlya Archipelago, Bol'shevik Island, Cape Antsev, 78°13'N, 103°15'E, 16.vii.2000, on *C. coccifera* (basal squamules), *N.V. Matveeva s.n.* (LE 309281); Taimyr Peninsula, Enisey

Bay, Sibiryakova Island, 72°50'N, 79°10'E, 19.vii.1990, on *C. coccifera* (podetia), *V.B. Kuvaev 1537* (LE 308815); Taimyr Peninsula, Tareya, 73°20'N, 90°36'E, 2.vii.1965, on *C. arbuscula* (podetia), *N.V. Matveeva s.n.* (LE 308750); Taimyr Peninsula, Pyasinskii Bay, Ptichii Island, 74°06'52"N, 86°35'04"E, 25.vii.1993, on *C. cyanipes* (podetia), *V.B. Kuvaev 2126* (LE 308514); Taimyr Peninsula, Syrutaturku Lake, 73°42'N, 97°40'E, 21.viii.1994, on *C. pyxidata* (moribund cups), *E.B. Pospelova* (LE 207410); Taimyr Peninsula, Levinson-Lessinga Lake, 74°31'N, 98°36'E, elev. 200 m, 26.viii.1995, on *C. pyxidata* (podetia), *M.P. Zhurbenko 95600a* (LE 308920a); elev. 300 m, 30.viii.1995, on *C. stricta* (podetia), *M.P. Zhurbenko 95593* (LE 308884); 74°24'N, 98°46'E, elev. 120 m, 28.viii.1995, on *Cladonia* sp. (podetia), *M.P. Zhurbenko 95599a* (LE 308916a), on *C. pyxidata* (podetia), *M.P. Zhurbenko 95594* (LE 308891). **TRANS-BAIKAL TERRITORY:** Kodar Range, Sul'ban River, Zolotoi Creek, 56°50'12"N, 117°17'21"E, elev. 1663 m, 14.vi.2015, on *C. borealis* (tips of podetia), *L.A. Konoreva s.n.* (LE 309227). **REPUBLIC OF SAKHA (YAKUTIA):** Daldyn River, 68°30'N, 124°00'E, 13.viii.1957, on *C. pyxidata* (podetia), *A.N. Lukicheva s.n.* (LE 308513a); Lena River delta, Samoilovskii Island, 72°22'N, 126°29'E, elev. 10 m, 26.vii.1998, on *C. furcata* (podetia), *M.P. Zhurbenko 98414* (LE 308900); Bytantai River basin, lower Kel'-Sene River, 20.ix.1965, on *C. verticillata* (podetia), *V.I. Perfil'eva s.n.* (LE 308765); Siibikte River, 15.viii.1957, on *C. subulata* (podetia), *A.N. Lukicheva s.n.* (LE 308805). **CHUKOTKA AUTONOMOUS AREA:** Wrangel' Island, Upper Mamontovaya River, 70°14'N, 179°35'E, 16.vii.1996, on *C. macroceras* (podetia), *S.S. Kholod s.n.* (LE 308825); Iskaten' pass, 66°35'N, 179°10'E, 3.vii.1971, on *C. coccifera* (podetia), *I.I. Makarova s.n.* (LE 308558); conjunction of Enmyvaam and Shumnaya Rivers, 68°15'N, 166°03'E, 3.vii.1980, on *C. coccifera* (podetia), *I.I. Makarova s.n.* (LE 308817); Pepenveem River, 65°55'N, 175°50'W, 3.viii.1970, on *C. coccifera* (podetia), *A.V. Galanin s.n.* (LE 308814); Palyavaam, 68°44'N, 173°50'E, 16.viii.1989, on *C. coccifera* (podetia), *B.A. Yurtsev s.n.* (LE 308784); Bezymyannoe Lake, 66°39'N, 176°40'E, on 5.vii.1979, *C. coccifera* (podetia), *I.I. Makarova s.n.* (LE 308783a); Televeem River, 65°50'N, 175°05'E, 22.vii.1979, on *C. cariosa* (basal squamules), *I.I. Makarova s.n.* (LE 308771). **MONGOLIA. UBSUNUR AIMAK:** Mt. Tsagan-Khairkhan-Ula, 49°23'N, 94°20'E, elev. 2100 m, 6.vii.1976, on *C. pleurota* (podetia), *L.G. Biazrov 3148* (LE 308842). **ARA-KHANGAI AIMAK:** 5 km SE of Tevshrulekh, elev. 1800 m, 27.viii.1980, on *C. digitata* (podetia), *L.G. Biazrov 4100* (LE 308845). **DZABKHAN AIMAK:** headwaters of Ubur-Teliin-Gol River, 48°30'N, 98°20'E, elev. 2120 m, 19.vi.1973, on *Cladonia* sp. (basal squamules, podetia), *L.G. Biazrov 2638* (LE 308848); 10 km W of Toson-Tsengel, elev. 2050 m, 3.vii.1976, on *C. chlorophaea* s. lat. (moribund podetia), *L.G. Biazrov 6354b* (LE 308871b). **CANADA. BRITISH COLUMBIA:** Columbia Mts., Beaver River, 51°15'N, 117°22'W, elev. 1150 m, 17.vii.2002, on *C. umbricola* (moribund bleached podetium), *M.P. Zhurbenko 02100f* (LE 308752); Wells Gray Provincial Park, Philip Creek, 52°52'N, 120°00'W, elev. 800 m, 30.vii.2002, on *C. symphycarpa* (podetia), *M. P. Zhurbenko 02278* (LE 308728). **NUNAVUT:** Ellef Ringnes Island, Isachsen Bay, 78°47'N, 103°33'W, elev. 40 m, 25.vii.2005, on *C. coccifera* (tips of moribund scyphi), *N.V. Matveeva s.n.* (LE 260706). **U.S.A. ALASKA:** Howe Island, 70°18'55"N, 147°59'35"W, elev. 17 m, 5.viii.2003, on *C. coccifera* (podetia), *D.A. Walker s.n.* (LE 308504b); Toolik Lake, 68°37.446'N, 149°36.457'W, elev. 770 m, 28.vii.2001, on *Cladonia* sp. (moribund podetia), *M.P. Zhurbenko 01448* (LE 309067); Brooks Range, Atigun Canyon, 68°26'42"N, 149°20'40"W, elev. 800 m, 31.vii.2001, on *C. coccifera* (moribund basal squamules and podetia), *M.P. Zhurbenko 01273* (LE 309066); Kotzebue, 66°53'N, 162°31'W, elev. 35 m, 19.viii.2000, on *C. arbuscula* (podetia), *M.P. Zhurbenko 00160a* (LE 309070a); 19.viii.2000, on *C. gracilis* s. lat. (podetia), *M.P. Zhurbenko 00176* (LE 309065); 19.viii.2000, on *C. deformis* (podetia), *M.P. Zhurbenko 00475* (LE 309064); Denali Highway, 64°04'N, 147°27'W, elev. 850 m, 3.ix.2000, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 00265b* (LE 309063); Denali National Park and Preserve, Rock Creek, 63°43.35'N, 148°57.53'W, elev. 650 m, 17.viii.2004, on *C. chlorophaea* s. lat. (podetia), *M.P. Zhurbenko 04222* (LE 309071); 20.viii.2004, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 04163* (LE 309069); 20.viii.2004, on *C. pyxidata* (podetia), *M.P. Zhurbenko 04177* (LE 309068), *M.P. Zhurbenko 04188b* (LE 309045b); Seward Peninsula, Mauze Creek, 65.4129°N, 164.6337°W, elev. 250 m, 22.vii.2000, on *C. coccifera* (podetia), *D.A. Walker* (LE 308557); Aleutian Islands, Amlia Island, 52.11332°N, 173.83478°W, 2.viii.2013, on *C. uncialis* (podetia), *S. Talbot & S. Talbot AML295* (H).

***Arthonia* cf. *lepidophila* (Anzi) Clauzade, Diederich & Cl. Roux comb. inval.**

DESCRIPTION. – *Apothecia* irregularly convex, sometimes applanate, brownish black, glossy, 50–300 µm lengthways, dispersed to aggregated and sometimes confluent. *Epihymenium* medium to dark olive brown or brown, K+ more olive. *Hymenium* light brownish gray, sometimes almost colorless below,

ca. 30 µm tall, I+ red, K/I+ blue. *Paraphysoids* flexuous, branched, apical cells 2.5–5.5 µm wide. *Subhymenium* light to medium olive brown or brown. *Asci* broadly clavate, 22–33 × 11–17 µm, 8-spored. *Ascospores* hyaline, soleiform/clavate (with enlarged upper cell), (9.5–)10.7–13.1(–16.0) × (3.5–)4.0–5.0(–6.5) µm, l/b = (2.1–)2.4–3.0(–3.7) (n = 107, in water or I), (0–)2-septate, smooth-walled, occasionally with halo 0.5–1 µm thick.

NOTES. – *Arthonia lepidophila* is an obscure species so far known from old reports from the Italian Alps growing on *Cladonia parasitica* and *C. pyxidata* (Anzi 1868, Clauzade et al. 1989, Keissler 1930). It differs from the examined material in having greenish pruinose ascomata, longer asci (ca. 60 × 10–12 µm) and fusiform, 1–3-septate ascospores. *Arthonia coniocraeae*, the only other *Arthonia* species with more than 1-septate ascospores known on *Cladonia*, differs in having a taller (60–80 µm), K+ dirty violet then gray hymenium, and brown, finely verrucose, 1(–2)-septate ascospores (Brackel 2010b). The examined material is conspecific with *Arthonia* sp. from Siberia described and illustrated in Zhurbenko and Zhdanov (2013). Possibly it just represents deviating forms of *Arthonia digitatae* with (0–)2-septate instead of typically 1-septate ascospores. But further study is needed. The species has been found on apothecia, podetia and/or basal squamules of *Cladonia capitellata*, *C. crispata*, *C. didyma*, *C. squamosa* and *Cladonia* spp.

Specimens examined. – **RUSSIA. NENETS AUTONOMOUS AREA:** Bol'shezemel'skaya tundra, Khar'yaga oilfield, 67°11'N, 56°30'E, elev. 60 m, 24.vii.2007, on *Cladonia* sp. (moribund podetia), *M.P. Zhurbenko 0776* (LE 308585). **TRANS-BAIKAL TERRITORY:** Kodar Range, Syul'ban River, 56°50'38"N, 117°18'05"E, elev. 1380 m, 13.vi.2015, on *Cladonia* sp. (basal squamules) growing on lignum, *S.V. Chesnokov s.n.* (LE 309349a). **SAKHALIN REGION:** Sakhalin Island, Palevo, 50°37'N, 142°43'E, 20.ix.2008, on *Cladonia* sp. (basal squamules), *N. A. Tsarenko s.n.* (LE 308647). **U.S.A. ALASKA:** Prince of Wales Island, Salt Chuck mine, 55°37'28"N, 132°33'04"W, elev. 5 m, 7.viii.2001, on *C. squamosa* (podetial squamules), *M.P. Zhurbenko 0115* (LE 309143). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Philip Creek, 52°52'N, 120°00'W, elev. 800 m, 30.vii.2002, on *C. crispata* (apothecia, podetia), *M.P. Zhurbenko 02164* (LE 308705). **VENEZUELA. MÉRIDA:** elev. 2300 m, 30.xii.1978, on *C. didyma* (podetia and podetial squamules), *M. López Figueiras 17497a* (H). **ECUADOR. AZUAY PROVINCE:** Parque Nacional El Cajas, elev. 3890 m, 26.iii.2014, on *Cladonia* sp. (decayng podetia and basal squamules), *X.Y. González Rentería s.n.* (H); 10.ix.2014, on *Cladonia* sp. (basal squamules), *X.Y. González Rentería s.n.* (H). **NEW ZEALAND. SOUTH ISLAND:** Denniston, 41.746°S, 171.799°E, elev. 660 m, 15.v.2010, on *C. capitellata* (podetia), *F. Högnabba 1728a* (H).

***Arthrorhaphis aeruginosa* R. Sant. & Tønsberg**

NOTES. – The first author has collected in the Arctic and boreal regions of Russia dozens of *Cladonia* specimens with sterile dark green spots, resembling the typical infection symptoms of this species. However, all of the aforementioned specimens were sterile and only a single fertile specimen of *Arthrorhaphis aeruginosa* is documented for Russia below. The species is newly reported for Russia, it was formerly known in Asia only from Iran (Sohrabi & Alstrup 2007) and Japan (Zhurbenko et al. 2015a).

Specimens examined. – **RUSSIA. TRANS-BAIKAL TERRITORY:** Kodar Range, Anarga River, 56°55'10"N, 118°00'04"E, elev. 1592 m, 10.vii.2013, on *Cladonia* sp. (basal squamules) on lignum, *L.A. Konoreva s.n.* (LE 309230). **U.S.A. ALASKA:** Revillagigedo Island, Carrol Inlet, 55°32'N, 131°17'W, elev. 250 m, 26.vi.2001, on *Cladonia* sp. (basal squamules), *K. Dillman 2001-258* (LE 309152).

***Bachmanniomyces uncialicola* (Zopf) D. Hawksw.**

NOTES. – The conidia in our material are simple, hyaline, usually more or less ellipsoid and acute at both apices (lens-shaped), occasionally obpyriform or limoniform, have truncate bases, sometimes narrowly so, and are (5.9–)7.5–9.9(–14.5) × (3.4–)4.1–4.9(–6.2) µm in size [l/b = (1.2–)1.7–2.2(–3.5) (n = 179)]. Hawksworth (1981) reported the conidia to be slightly wider than in our material [(7–)8–10(–10.5) × 4–5.5(–6) µm]. Typically the species induces distinct galls, but in LE 308802 gall formation was not observed despite the presence of abundant conidiomata scattered over podetia of *Cladonia amaurocraea*. It is noteworthy that Diederich (2003: 49) also reported a specimen of *Bachmanniomyces uncialicola* (on *Cladonia portentosa*) without conspicuous galls.

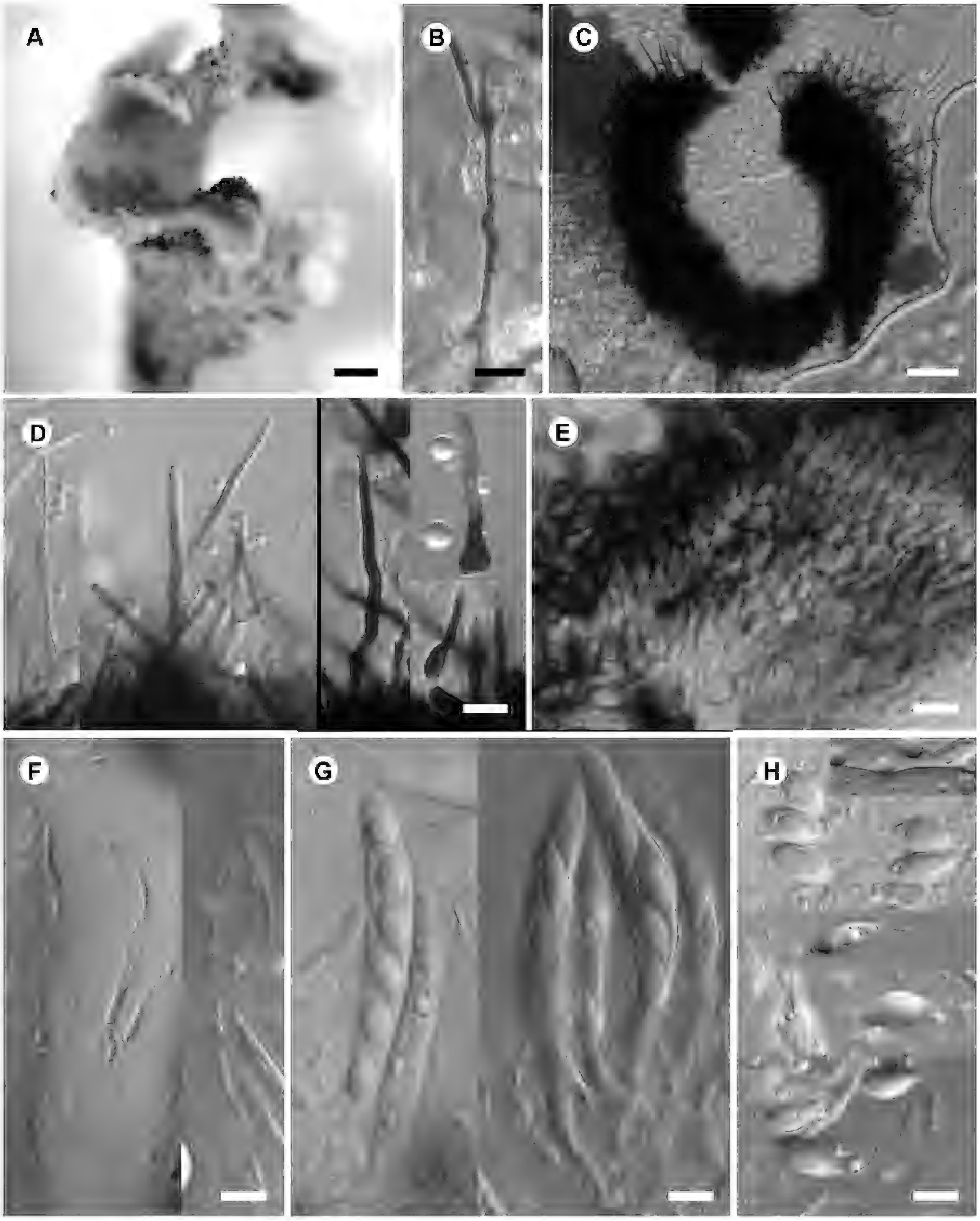

Figure 1. *Biciliopsis cladoniae* (all from the holotype). **A,** ascoma. **B,** vegetative hyphae in K. **C,** ascoma in cross section in water. **D,** setae in water (left) and in K (right). **E,** ascomatal wall in cross section in water. **F,** possible interascal hyphae in I. **G,** asci in water (left) and I (right). **H,** ascospores in water. Scale bars: A = 200 µm, B & D–H = 10 µm, C = 50 µm.

This species has been found on the podetia or rarely the basal squamules of *Cladonia amaurocraea*, *C. arbuscula*, *C. pyxidata*, *C. rangiferina*, *C. stygia*, *C. subfurcata*, *C. subsubulata* and *C. uncialis*. It is here reported new to Argentina and *C. rangiferina*, *C. subfurcata* and *C. subsubulata* are new host species.

Specimens examined. – **FINLAND. KANTA-HÄME:** Torronsuo National Park, 60°44'N, 23°43'E, 31.x.2014, on *Cladonia stygia* (podetia), *R. Pino-Bodas s.n.* (H). **FINLAND PROPER:** Salo, 60°25'12"N, 23°09'12"E, elev. 20 m, 24.v.2015, on *C. uncialis* (podetia), *R. Pino-Bodas s.n.* (H). **RUSSIA. REPUBLIC OF ADYGEYA:** Caucasus, Mt. Tybga, 43°52'48"N, 40°15'59" E, elev. 2480 m, 6.viii.2014, on *C. arbuscula* (podetia), *M.P. Zhurbenko 14426* (LE 309442). **YAMAL-NENETS AUTONOMOUS AREA:** watershed of Pur and Taz Rivers, 21.viii.1990, on *C. amaurocraea* (podetia), *G.E. Vil'chek s.n.* (LE 308839). **KRASNOYARSK TERRITORY:** Taimyr Peninsula, Enisey Bay, Sibiryakova Island, 72°50'N, 79°10'E, 31.vii.1989, on *C. subfurcata* (podetia), *V.B. Kuvaev 1331* (LE 308785); Taimyr Peninsula, Ladanakh Lake, 70°00'N, 87°30'E, elev. 50 m, 24.vii.1983, on *C. pyxidata* (basal squamules), *M.P. Zhurbenko 8353* (LE 308903). **CHUKOTKA AUTONOMOUS AREA:** headwaters of Enmil'veergin River, 12.viii.1951, on *C. stygia* (podetia), *Ababkov s.n.* (LE 308754); Iskaten' Pass, 66°35'N, 179°10'E, 7.1967, on *C. amaurocraea* (podetia), *Voronova s.n.* (LE 308802); Bering Strait, Ratmanova Island, 65°47'N, 169°03'W, 4.viii.1958, on *C. subfurcata* (podetia), *B.A. Tikhomirov s.n.* (LE 308822a). **U.S.A. ALASKA:** Kotzebue, 1961, on *C. stygia* (podetia), *B. Neiland s.n.* (LE 309095); Great Kobuk Sand Dunes, 67°08'N, 159°03'W, elev. 65 m, 15.viii.2000, on *C. rangiferina* (podetia), *M.P. Zhurbenko 00114b* (LE 308490b); 66°59'N, 158°47'W, elev. 300 m, 31.vii.2000, on *C. uncialis* (podetia), *M.P. Zhurbenko 00134* (LE 309094); Seward Peninsula, Guy Rowe Creek, 64.7507°N, 163.8938°W, elev. 174 m, 17.vii.2000, on *C. uncialis* (podetia), *D.A. Walker s.n.* (LE 309092); Ophir Creek, 64.9276°N, 163.7418°W, elev. 76 m, 2000, on *C. amaurocraea* (podetia), *D.A. Walker s.n.* (LE 309093); Aleutian Islands, Adak Island, Mt. Reed, 51°49'55"N, 176°40'29"W, elev. 130 m, 28.viii.2013, on *C. uncialis* (podetia), *S. Talbot & S. Talbot ADA726a* (H). **ARGENTINA. LOS ESTADOS ISLAND:** Bahia Flinders, elev. 75 m, 7.xi.1971, on *C. subsubulata* (podetia), *H. Imshaug 53524a & K. Ohlsson* (H).

***Biazrovia stereocaulicola* Zhurb. & Etayo**

NOTES. – Previously this species was known from two localities in Siberia where it was found growing on terricolous *Stereocaulon* species (Zhurbenko & Etayo 2013). The examined material perfectly fits the protoloque, except for having somewhat smaller asomata (70–120 µm vs. 100–250 µm in diameter), and ascospore walls that are not consistently smooth, but also occasionally granulate. The species is here repored new to North America and *Cladonia* is reported as a new host genus.

Specimen examined. – **U.S.A. ALASKA:** Denali National Park and Preserve, 63°43.35'N, 148°57.53'W, elev. 650 m, 20.viii.2004, on *Cladonia pyxidata* (partly moribund basal squamules), *M.P. Zhurbenko 04381* (LE 309169).

***Biciliopsis cladoniae* Zhurb., Pino-Bodas & Diederich, sp. nov.**

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FIGURE 1

DIAGNOSIS. – Lichenicolous fungus. Morphologically similar to *Biciliopsis leptogiicola*, but distinguished mainly by the absence of a stroma, erumpent vs. superficial ascomata, the presence of setae and interascal hyphae, 4(–6)-spored vs. 2-spored asci, and a different host, *Cladonia* vs. *Leptogium*.

TYPE: **FRANCE (OVERSEAS DEPARTMENT). RÉUNION:** Takamaka, feuchte waldige Felshänge neben der Elektrostation, 21.09105°S, 55.61998°E, elev. 800 m, 10.ix.2009, on *Cladonia ceratophylla* (squamules), *F. Schumm & J.-P. Frahm 15283* (H!, holotype).

DESCRIPTION. – *Vegetative hyphae* light to medium brown, septate, 2–5 µm in diameter. *Ascomata* perithecioid, brownish black, matt, subglobose to broadly ovate, up to 350 µm in diameter, up to 380 µm tall, non-papillate, ostiolate, setose, initially immersed, finally to about 1/3 exposed (sometimes on both sides of the host squamules), dispersed to occasionally adjacent. *Setae* light to mainly medium or dark brown, sometimes paler above, 0(–2)-septate, straight, (20–)35–69(–75) µm long (n = 12), expanded at the

base, 3–4 µm in diameter below, gradually tapering to 2–2.5 µm in diameter above, with rounded tip, not branched. *Exciple* medium to dark brown, 20–30 µm thick, composed of pseudoparenchymatous or tangentially elongated thin-walled cells. Interior of ascomata without lipid drops, I and K/I–. *Interascal hyphae* hyaline, septate, occasionally branched, up to 120 µm long, 1.5–6.5 µm in diameter, gradually tapering to the tip. *Periphyses* hyaline, septate, occasionally branched. *Asci* non-fissitunicate, subcylindrical or mainly slightly swollen in the upper half (claviform) or in the middle, rounded at the apex, wall thin, apically somewhat thickened and without visible structures, (95–)102–123(–130) × (9–)10–12 (n = 14, in water or I), I and K/I–, 4(–6)-spored. *Ascospores* hyaline, bicaudate with tail-like filiform appendages ca. 0.5 µm in diameter, (13–)19–27(–30) µm long (n = 23) at each end, bodies narrowly to broadly ellipsoid, (12.0–)14.1–17.5(–19.7) × (5.3–)6.8–8.2(–9.2) µm, l/b = (1.5–)1.8–2.4(–3.2) (n = 69), aseptate, with a smooth wall ca. 0.5 µm thick, overlappingly uniseriate in the ascus. *Anamorph* not found.

ETYMOLOGY. – The epithet refers to the host lichen genus *Cladonia*.

DISTRIBUTION AND HOST. – The new species is known only from the type specimen collected in a mountain forest in the Paleotropics (Réunion Island), growing on squamules of *Cladonia ceratophylla*. Pathogenicity not observed.

DISCUSSION. – By its bicaudate ascospores this fungus morphologically stands out among lichenicolous fungi, where distinct caudae are known only from *Biciliopsis leptogiicola* Diederich, *Capronia paranectrioides* Etayo, Flakus & Kukwa and *Paranectria* species (Aptroot et al. 1997, Etayo et al. 2013, Hawksworth 1982, Rossman et al. 1999, Zhurbenko 2009c). The species is placed in the so far monotypic genus *Biciliopsis* Diederich with some hesitation due to the following differences with the protologue (Aptroot et al. 1997): 1) ascomata erumpent, dispersed, stroma absent vs. ascomata superficial, aggregated on black stroma; 2) ascomata with true setae vs. ascomata without setae, but with external hyphae arising from its outer wall; 3) presence vs. absence of interascal hyphae; 4) 4(–6)-spored vs. 2-spored asci. By the setose ascomata and characteristics of interascal hyphae, exciple and asci, the examined material is also reminiscent of species of *Roselliniella*, including *R. cladoniae* (Anzi) Matzer & Hafellner growing on *Cladonia*. However, the latter species readily differs in the absence of true setae and in its medium brown mature ascospores that are up to 4-septate, sometimes with a small apical beak, but without distinct caudae (Matzer & Hafellner 1990, and herein).

***Brackelia* Zhurb., gen. nov.**

MycoBank #MB 819555

DIAGNOSIS. – Apothecia dark brown to almost black, glossy, epruinose, superficial, roundish, disc plane, margin sometimes raised. Exciple composed of cells with rounded or tangentially elongated lumina, not radiating, without hairs, laterally brownish orange, basally subhyaline. Epihymenium indistinct. Hymenium hyaline to medium brown or brownish orange, not inspersed, I and K/I–. Subhymenium hyaline to brownish. Paraphyses hyaline, light to medium brown or brownish orange, filiform, sometimes slightly gradually clavate above, occasionally branched below, remotely septate, not constricted at the septa, easily separating in K. Asci non-fissitunicate, narrowly clavate, apex rounded, apical wall thickened, apical structures not observed, I and K/I–, 8-spored. Ascospores hyaline, ellipsoid to very narrowly obovate, 0(–1)-septate, guttulate, wall smooth, without gelatinous sheath, diagonally uniseriate to irregularly biseriate in the ascus.

GENERIC TYPE: *Brackelia lunkei* Zhurb.

ETYMOLOGY. – Named in honor of Wolfgang von Brackel for his outstanding contribution to the knowledge of lichenicolous fungi.

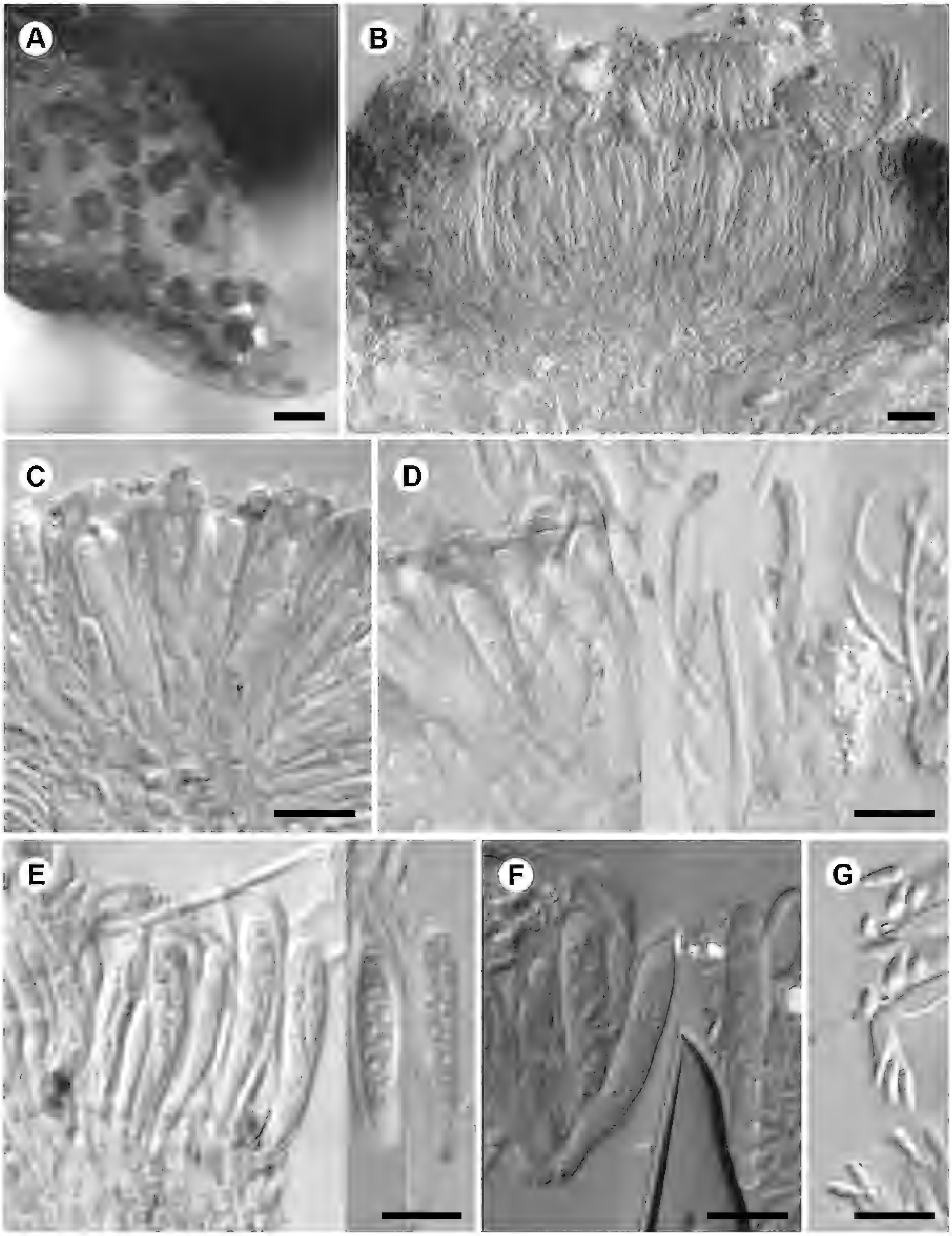

Figure 2. *Brackelia lunkei* (all from the holotype). **A,** apothecia. **B,** squashed cross section of apothecium in water. **C,** asci and paraphyses in water. **D,** asci and paraphyses in K. **E,** asci in K/I. **F,** asci in Phloxine B after 10% KOH pre-treatment. **G,** ascospores in K. Scale bars: A = 100 µm, B–G = 10 µm.

***Brackelia lunkei* Zhurb., sp. nov.**
MycoBank #MB 819556

FIGURE 2

DIAGNOSIS. – Lichenicolous fungus. Morphologically similar to *Llimoniella phaeophysciae*, but distinguished by the presence of an indistinct epihymenium, poorly developed, subhyaline basal exciple, often pigmented paraphyses, asci with rounded apex and distinct tholus, ellipsoid to very narrowly obovate, 0(–1)-septate ascospores, and a different host, *Cladonia* vs. *Phaeophyscia*.

TYPE: **RUSSIA. ALTAI TERRITORY:** Solonesh Region, Bashchelak Range, middle reaches of Shinok River, 51°22'N, 84°37'E, elev. 1000 m, extensive treeless area with big stones and *Cladonia* carpets among *Larix* taiga forest, 22.vii.1996, on *Cladonia amaurocraea* (hymenium), *T. Lunke 451b* (LE 308941!, holotype; herb. Diederich!, isotype).

DESCRIPTION. – *Ascomata* apothecia, dark brown to almost black, glossy, epruinose, superficial with somewhat immersed base, more or less roundish in surface view, (30–)55–90(–120) µm in diameter (n = 54), 15–30 µm tall; disc more or less plane, concolorous or slightly paler than margin; margin 15–25 µm thick, raised or at the disc level, sometimes lacerate; dispersed to occasionally adjacent. *Exciple* composed of cells with rounded or tangentially elongated lumina, 3–6 × 2–4 µm, with walls 0.5–1.5 µm thick; laterally medium brownish orange, 10–20 µm thick, not radiating, without enlarged end cells or hairs; basally rather indistinct, subhyaline, 10–15(–30) µm thick. *Epihymenium* indistinct. *Hymenium* hyaline to light or medium brown or brownish orange, pigmentation is more saturated above and in the aged apothecia, not inspersed, 30–45 µm tall, I and K/I–. *Subhymenium* hyaline to brownish, ca. 5 µm tall. *Paraphyses* hyaline, light to medium brown or brownish orange, pigmentation usually gradually fading from the apex to the base and becoming more saturated under maturation, filiform, 1.2–2.5(–3.5) µm in diameter, apices sometimes slightly clavate, occasionally branched below, remotely septate, not constricted at the septa, easily separating in K under slight pressure on cover glass. Pigmentation of the exciple and hymenium becomes yellowish-brown in K and slightly more orange in N. *Asci* non-fissitunicate, narrowly clavate, apex rounded, tholus up to 2.5 µm tall, apical structures not observed, (31–)32–41(–45) × 5–6(–7) µm (n = 32, in water, K/I or Phloxine B), I and K/I–, 8-spored. *Ascospores* hyaline, ellipsoid to very narrowly obovate, (5.3–)6.1–9.1(–10.9) × (1.5–)1.7–2.0(–3.2) µm, l/b = (2.8–)3.2–4.4(–5.5) (n = 60, in water, I, K, K/I or Phloxine B), 0(–1)-septate, not constricted at the septum, guttulate, wall thin, smooth, without gelatinous sheath, diagonally uniseriate to irregularly biseriate in the ascus. *Anamorph* not found.

ETYMOLOGY. – Named in honor of Thomas Lunke, who collected the holotype.

DISTRIBUTION AND HOSTS. – The new species is known from two collections made in the boreal forest (taiga) biome of Asia and North America, where it grew on the hymenia of apothecia of *Cladonia amaurocraea* and *C. coccifera*. Infections were partly associated with bleached or blackened parts of the hymenium.

DISCUSSION. – Compared to other lichenicolous Helotiales, *Brackelia lunkei* seems to be most similar to species of *Llimoniella* Hafellner & Nav.-Ros., particularly to the *L. phaeophysciae* group (Diederich & Etayo 2000, Diederich et al. 2010, Hafellner & Navarro-Rosinés 1993). However, species of *Llimoniella* differ in several important characters, such as the exciple, typically consisting of radiating hyphae composed of more or less isodiametric cells, with enlarged end (outer) cells. In additional to the anatomy of the exciple, the generic type *L. scabridula* (Müll. Arg.) Nav.-Ros. & Hafellner is distinguished from the new species by a purplish, K+ violet, N+ orange or red hymenium and exciple. *Llimoniella phaeophysciae* Diederich, Ertz & Etayo has a similarly colored, K–, N+ brighter orange exciple and hymenium, but differs in having a distinct epihymenium, a dark basal exciple that is sometimes elongated into a stipe, colorless paraphyses, asci that are more or less applanate at the apex, with a slightly thinner apical wall, and subglobose to short ellipsoid, aseptate, uniseriate ascospores.

By its tiny ascomata confined to the hymenia of the host apothecia the new taxon is reminiscent of *Hymenobia insidiosa* Nyl., a species that mainly occurs in the hymenium of *Lecidea* species [Triebel 1989; as *Hymenobiella aporea* (Nyl.) Triebel]. However, that species is distinguished by its perithecium-like ascomata, an I+ red and K/I+ blue hymenium, and gall induction.

Among the other cladoniicolous fungi (see the key herein), *Brackelia lunkei* is most similar to *Phaeopyxis punctum*, from which it differs in smaller and consistently superficial ascomata, an indistinct epihymenium, K/I– asci, and smaller, aseptate ascospores.

Additional specimen examined. – **U.S.A. ALASKA:** Great Kobuk Sand Dunes, 67°04'N, 158°54'W, elev. 50 m, sparse *Picea glauca* forest, 1.viii.2000, on *Cladonia coccifera* (hymenium), *M.P. Zhurbenko 0090* (LE 309167).

***Caeruleoconidia* Zhurb. & Diederich, gen. nov.**
MycoBank #MB 819620

≡ *Caeruleoconidia* Zhurb. & Diederich *nom. inval.* (Art. 40.1) *in* Zhurbenko, Frisch, Ohmura & Thor, Herzogia 28: 764. 2015.
MycoBank #MB 814592

DIAGNOSIS. – *Conidiomata* pycnidioid or sporodochioid to pulvinate, but sometimes with a lateral ring-like rudimentary wall, blackish, stromatic, erumpent. *Conidiophores* hyaline to bluish green, composed of cells resembling conidia or vertically elongated cells, densely aggregated into a compact basal stroma. *Conidiogenous cells* hardly distinguishable from the underlying stromatic cells. *Conidia* holoblastic, bluish green, K+ becoming greener, mainly subglobose, solitary to indistinctly catenate, dry, 0(–1)-septate, smooth-walled.

GENERIC TYPE: *Caeruleoconidia ochrolechiae* Zhurb. & Diederich.

ETYMOLOGY. – The generic name refers to the peculiar bluish green conidia of the type species.

NOTES. – The name *Caeruleoconidia* was originally introduced in Zhurbenko et al. (2015a) to accommodate *C. ochrolechiae* Zhurb. & Diederich. Unfortunately an identifier issued by a recognized repository was not cited in the protologue of *C. ochrolechiae* and thus its description does not meet the requirments of Art. 42.1 of the *Melbourne Code* (McNeill et al. 2012). These names are validly published herein, along with the description of a second species of the genus. For a comparison of *Caeruleoconidia* with the most similar genera *Coniambigua* Etayo & Diederich and *Epaphroconidia* Calat. & V. Atienza refer to Zhurbenko et al. (2015a).

***Caeruleoconidia ochrolechiae* Zhurb. & Diederich, sp. nov.**
MycoBank #MB 819621

≡ *Caeruleoconidia ochrolechiae* Zhurb. & Diederich *nom. inval.* (Art. 42.1) *in* Zhurbenko, Frisch, Ohmura & Thor, Herzogia 28: 764. 2015.
MycoBank #MB 817479

DIAGNOSIS. – Lichenicolous fungus. *Conidiomata* sporodochial to pulvinate, but sometimes with a lateral ring-like rudimentary wall, convex to applanate, black, stromatic, erumpent. *Conidiophores* hyaline to light bluish green, densely aggregated in a compact basal stroma. *Conidiogenous cells* hardly distinguishable from the underlying stromatic cells. *Conidia* holoblastic, light to moderate bluish green, K+ becoming greener, mainly subglobose to irregularly ellipsoid or rectangular, mainly 5.2–7.2 × 4.1–5.5 µm, abundant, solitary to indistinctly catenate, dry, 0(–1)-septate, with smooth wall.

TYPE: **MEXICO. CHIHUAHUA:** ridge crest area along a secondary dirt road to Casas Grandes from Bavispé, Sonora, 30°24'20"N, 108°24'20"W, elev. 2180 m, open pine-juniper-manzanita area, 18.vii.1994, on *Ochrolechia pseudopallescens* (discs and margins of apothecia, thallus), *T.H. Nash III 36366a* (ASU!, holotype; herb. Diederich!, isotype).

ETYMOLOGY. – The epithet refers to the host lichen genus *Ochrolechia*.

NOTES. – For detailed information on the morphology, taxonomic position, distribution and hosts of this species refer to Zhurbenko et al. (2015a).

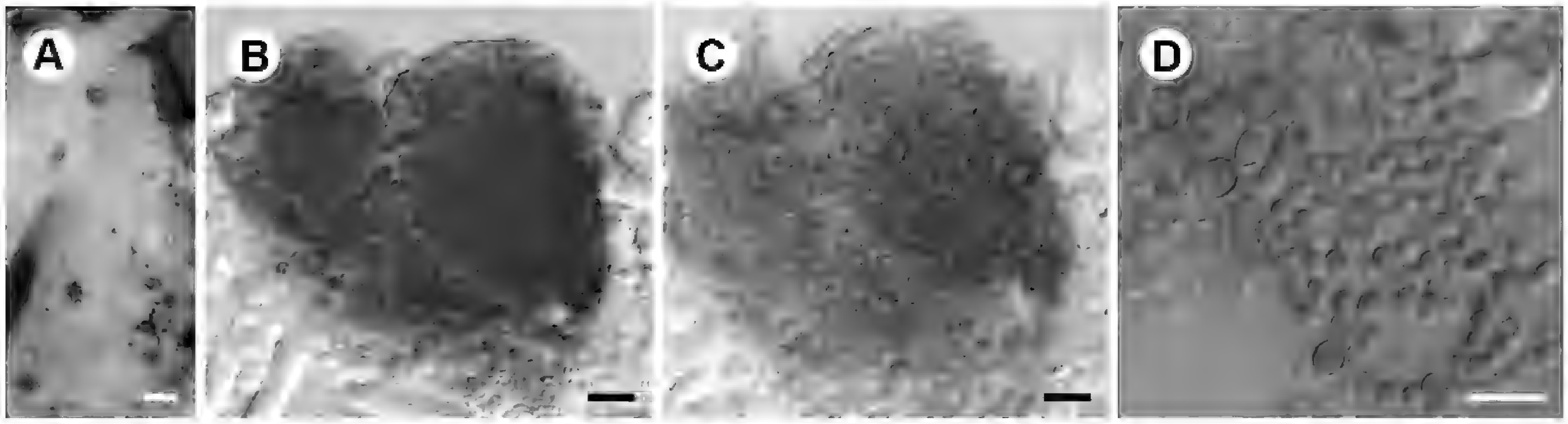

Figure 3. *Caeruleoconidia biazrovii* (A from LE 308876, B-D from the holotype). **A,** conidiomata. **B,** conidioma in cross section in water. **C,** conidioma in cross section in K. **D,** conidia and details of conidiogenesis in K. Scale bars: A = 100 µm, B–D = 10 µm.

Caeruleoconidia biazrovii **Zhurb., sp. nov.**
MycoBank #MB 819622

FIGURE 3

DIAGNOSIS. – Lichenicolous fungus. Morphologically similar to *Caeruleoconidia ochrolechiae*, but distinguished primarily by the smaller conidiomata, 30–80 µm vs. 50–190 µm in diameter, the smaller conidia, mainly 3.5–5 × 3–4.5 µm vs. 5–7 × 4–5.5 µm, and a different host, *Cladonia* vs. *Ochrolechia*.

TYPE: **MONGOLIA. ARA-KHANGAI AIMAK:** E shore of Terkhiin-Tsagan-Nur Lake, 48°10'N, 99°43'E, elev. 2100 m, lava field among sparse *Larix* forest, 21.viii.1972, on *Cladonia stellaris* (upper parts of podetia), *L.G. Biazrov 1839* (LE 308849!, holotype).

DESCRIPTION. – *Conidiomata* pycnidioid or sporodochioid, blackish, rounded to angular in surface view, convex to applanate, 30–80 µm in diameter, stromatic, initially immersed in the host thallus, later erumpent, dispersed; completely or only laterally covered by a poorly developed subhyaline, grayish, olivaceous or blue-green wall ca. 3–5 µm thick, composed of tangentially elongated cells. *Conidiophores* hyaline below to medium bluish green (sometimes with an olive tinge) above, densely aggregated into a compact basal stroma, composed of cells that are vertically strongly elongate or similar in shape and size to the conidial cells. *Conidiogenous cells* arising from the basal stroma, indistinguishable from the underlying stromatic cells. *Conidia* holoblastic, very light to medium bluish green, K+ light green, angular subglobose, occasionally oblong or ovoid, solitary to indistinctly catenate, (2.8–)3.3–4.9(–6.3) × (2.5–)3.1–4.3(–5.3) µm, l/b = (0.8–)1.0–1.2(–1.8) (n = 76, in water or K), dry, aseptate, with smooth wall ca. 0.5 µm thick.

ETYMOLOGY. – The new species is named in honor of the distinguished Russian lichenologist Lev G. Biazrov, who collected the type material.

DISTRIBUTION AND HOST. – The new species is known from two specimens collected in sparse mountain *Larix* forests of Eastern Asia (Mongolia), where it was found on healthy-looking podetia of *Cladonia stellaris*. Pathogenicity was not observed.

DISCUSSION. – *Caeruleoconidia biazrovii* clearly differs from the other known species of the genus, *C. ochrolechiae*, which has larger conidiomata (50–190 µm in diameter) and 0(–1)-septate, larger conidia (mainly 5–7 × 4–5.5 µm).

Additional specimen examined. – **MONGOLIA. DZABKHAN AIMAK:** 12 km W of Toson-Tsengel, elev. 2100 m, sparse *Larix* forest, 2.vii.1976, on *Cladonia stellaris* (upper parts of podetia), *L.G. Biazrov 6560* (LE 308876).

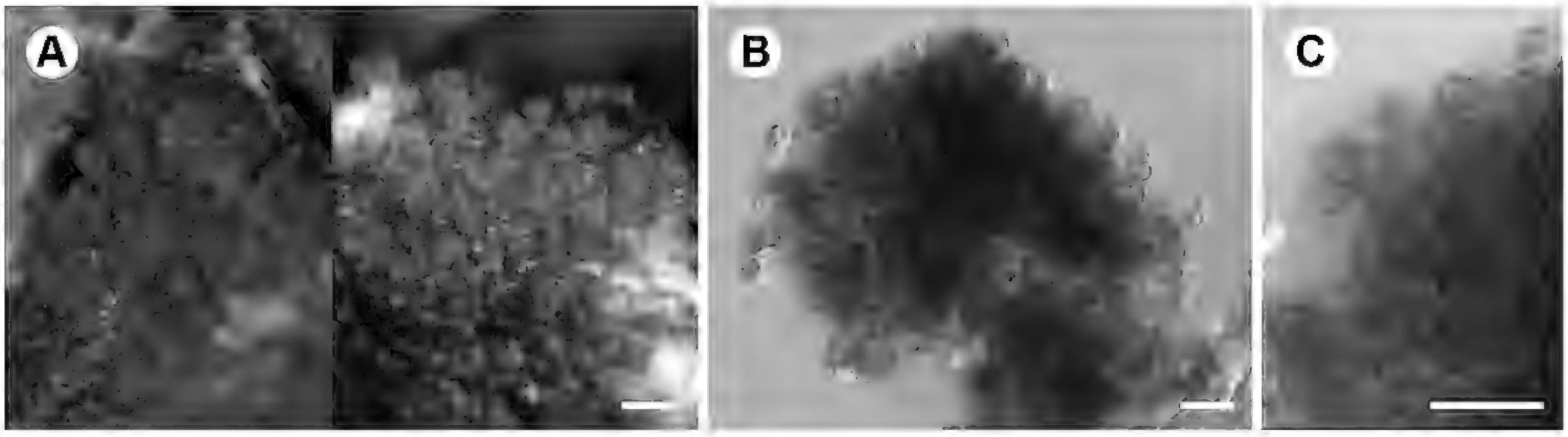

Figure 4. *Cladophialophora* aff. *cladoniae* (all from LE 308669). **A,** sporodochia. **B,** squashed cross section of sporodochium in water. **C,** conidia in water. Scale bars: A = 100 µm, B & C = 10 µm.

Cercidospora cladoniicola **Alstrup**

DESCRIPTION. – *Ascomata* black, subglobose, 80–100(–200) µm in diameter, more or less protruding above. *Exciple* mainly olive to brown, sometimes partly reddish purple brown, grayish olive or blue-green, paler to subhyaline at the base, not distinctly changing color in K. *Asci* (4–)8-spored. *Ascospores* hyaline to sometimes light brown, mostly clavate (wider above) or sometimes fusiform (mostly fusiform in LE 261631), (11.0–)13.3–17.5(–21.9) × (2.7–)4.0–5.2(–6.0) µm, l/b = (2.0–)2.8–4.0(–5.1) (n = 166, in water or K), (0–)1–3-septate (usually 3-septate, but in some specimens mostly 1-septate), sometimes constricted at the septa, smooth, halo not seen.

NOTES. The protologue of this species characterized the exciple as brown and the ascospores as 3-septate, with narrower lower cells (16–20 × 5–6 µm) (Alstrup 1997). The material we examined shows significant variation in color and shape of the exciple, size and septation of ascospores, and thus is possibly heterogenous. The specimens we examined were found on basal squamules and/or podetia of *Cladonia coccifera*, *C. mitis* and *C. sulphurina*. The species is newly reported for Asia, as it was formerly known in Russia only from Northern Ural (Zhurbenko 2004). *Cladonia coccifera* and *C. sulphurina* are new host species.

Specimens examined. – **RUSSIA. REPUBLIC OF BURYATIA:** SE coast of Baikal Lake, 5 km SW of Turka, 52°50'50"N, 108°00'50"E, elev. 460 m, 25.viii.2002, on *Cladonia mitis* (podetia), *M.P. Zhurbenko 02408* (LE 309153). **REPUBLIC OF SAKHA (YAKUTIA):** Bytantai River basin, lower Kel'-Sene River, 18.ix.1965, on *C. sulphurina* (podetia), *V.I. Perfil'eva s.n.* (LE 308763). **MAGADAN REGION:** Magadan, Snezhnaya Dolina, 59°44'N, 150°50'E, elev. 200 m, 26.vi.1972, on *C. coccifera* (basal squamules, occasionally podetia), *L. Blagodatskikh s.n.* (LE 308751).

Chaenothecopsis parasitaster **(Bagl. & Carestia) D. Hawksw.**

NOTES. – Formerly known in Russia from the Krasnoyarsk Territory, Republic of Buryatia and Kamchatka Territory (Kharpukhaeva 2013, Stepanchikova & Himelbrant 2011, Zhurbenko 2009b). We report two additional records from Russia here.

Specimens examined. – **RUSSIA. REPUBLIC OF BURYATIA:** Dzherginskii Reserve, Kovyli River, 55°07'18"N, 111°28'00"E, elev. 900 m, 14.vii.2002, on *Cladonia digitata* (basal squamules, podetia), *T.M. Kharpukhaeva s.n.* (LE 308566). **CHUKOTKA AUTONOMOUS AREA:** Mt. Gil'mymlinei, 65°53'N, 173°44'W, 2.vii.1977, on *C. sulphurina* (podetia), *I.I. Makarova s.n.* (LE 308808).

Cladophialophora **aff.** ***cladoniae*** **(Diederich) Diederich**

FIGURE 4

DESCRIPTION. – *Conidiomata* sporodochial, grayish brown, superficial, more or less convex, (37–)49–79(–97) µm in diameter (n = 37), up to 65 µm tall, dispersed to occasionally adjacent or confluent. *Conidia* light reddish brown, more or less orbicular to occasionally broadly ellipsoid, 0(–1)-septate, possibly very rarely narrowly ellipsoid and 2-septate, aseptate conidia (3.1–)4.0–5.0(–5.7) × (2.8–)3.5–

4.3(–5.1) µm, l/b = 1.0–1.2(–1.7) (n = 90), 1-septate conidia 5.7–6.9 × 3.7–4.9 (n = 9), not adhering in chains, wall 0.6–0.8 µm thick, evenly colored, indistinctly verruculose.

NOTES. – The examined material exhibits several discrepancies with the species protologue, where the sporodochia were reported to be much smaller [7–20(–30) µm in diameter], and conidia reported to be much smaller (2.2–3 µm in diameter), uniformly aseptate, smooth-walled and adhering in short chains (Diederich 2010). It is possible that these differences reflect the limited material available for the description, since *Cladophialophora cladoniae* was previously known only from the type locality in Luxembourg where it grew on *Cladonia pocillum* and *C. subulata* (Diederich 2010).

Specimen examined. – **RUSSIA. KRASNOYARSK TERRITORY:** Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 54°00'N, 95°29'E, elev. 1400 m, 20.vii.2009, on *Cladonia pocillum* (darkened basal squamules), *M.P. Zhurbenko 0968* (LE 308669).

***Coniochaeta* sp.**

FIGURE 5

DESCRIPTION. – *Ascomata* subglobose to pyriform, ca. 150 µm in diameter, superficial, densely covered by aseptate setae 20–40 µm long. *Ascospores* medium to dark brown, discoid, subglobose to ellipsoid, (7.9–)8.4–10.6(–12.9) × (4.6–)6.3–9.1(–11.5) µm, l/b = (1.0–)1.1–1.5(–2.1) (n = 27), aseptate, smooth-walled, uniseriate in the asci.

NOTES. – This species resembles *Roselliniella cladoniae*, which readily differs in having larger ascomata without true setae, and 0(−2)-septate, larger ascospores (see notes on that species below). A BLAST search of an ITS sequence (KY775602) recovered 99% similarity (558 bp identical of 562 bp aligned) with *Coniochaeta ligniaria* (Grev.) Cooke (KP941078), however, according to Munk (1957) that species differs in having larger ascomata (200–350 µm in diameter), and discoidal, larger ascospores [(9–)12–14(–20) × 8–12(–15) × 4–6 µm]. Species of *Coniochaeta* (Sacc.) Cooke usually grow on decaying wood and bark, but have also exceptionally been documented on lichens, viz. *C. ligniaria* on *Diploschistes diacapsis* (Etayo 2008).

Specimen examined. – **FINLAND. UUSIMAA PROVINCE:** Espoo, Takkula, 400 m SE of Vaakkoi Lake, 60°20'N, 24°33'E, elev. 90 m, 19.viii.2014, on *Cladonia coccifera* (podetia), *R. Pino-Bodas s.n. & T. Ahti s.n.* (H).

***Dactylospora deminuta* (Th. Fr.) Triebel**

NOTES. – In our material the ascospores are initially light olive turning medium brown, narrowly ellipsoid/fusiform to occasionally oblong, (3–)5–7(–8)-transseptate, rarely with an additional oblique septum, and (14.2–)16.9–21.7(–28.0) × (4.0–)4.7–5.9(–7.0) µm in size [l/b = (2.7–)3.2–4.0(–5.7) (n = 79)]. This species has been found on various distantly related lichens, including species of *Cladonia* (Zhurbenko & Alstrup 2004). *Cladonia rangiferina* is here reported as a new host species.

Specimens examined. – **RUSSIA. KRASNOYARSK TERRITORY:** Severnaya Zemlya Archipelago, Bol'shevik Island, Cape Baranova, 79°16'N, 101°40'E, elev. 20 m, 13.vii.1996, on *Cladonia rangiferina* (podetia) and adjacent terricolous lichens, *M.P. Zhurbenko 961032* (LE 308918); Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°28'E, elev. 1450 m, 14.vii.2009, on *C. pyxidata* (moribund basal squamules) and adjacent terricolous lichens, *M.P. Zhurbenko 0971* (LE 308672).

***Dactylospora* sp.**

DESCRIPTION. – *Epihymenium* light to medium reddish brown. *Hymenium* hyaline to partly slightly reddish brown. *Exciple* medium to dark reddish brown, without violet, K+ aeruginose patches; reddish tinge of the apothecial section disappears in K. *Ascospores* ellipsoid to narrowly ellipsoid or occasionally slightly wider above, medium brown when mature, (9.3–)12.7–17.3(–19.7) × (4.0–)5.0–6.2(–7.3) µm, l/b = (1.3–)2.2–3.2(–3.7) (n = 84, in water or K), (0–)3-septate, sometimes constricted at the septa, smooth, non-halonate.

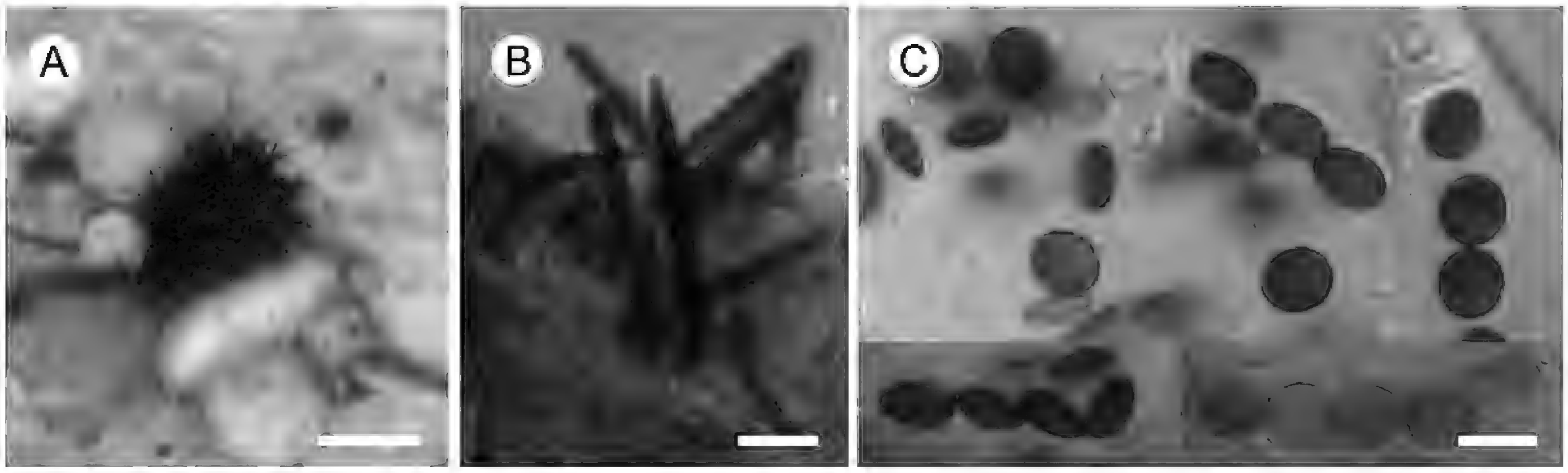

Figure 5. *Coniochaeta* sp. (all from *Pino-Bodas & Ahti s.n.*). **A,** ascoma. **B,** setae in water. **C,** ascospores in water. Scale bars: A = 100 µm, B & C = 10 µm.

NOTES. – Among the *Dactylospora* species with up to 3-septate ascospores, our material is most reminiscent of *D. rhyparizae* Arnold, so far reported only from the terricolous lichen *Bryodina rhypariza* (Lawrey & Diederich 2016). *Dactylospora rhyparizae* has ascospores of a very similar size [(9.5–)12.9–16.9(–18.0) × (5.0–)5.3–6.7(–7.5) µm, l/b = (1.6–)2.1–2.9(–3.6) (n = 63, in water or K)], but differs in having a brown epihymenium and exciple without red tinge that sometimes has violet, K+ aeruginose patches.

Specimens examined. – **RUSSIA. MAGADAN REGION:** M. Gor'kii mine, 62°36'11"N, 150°18'05"E, 12.ix.1949, on *Cladonia stygia* (bases of podetia), *A.M. Fisher s.n.* (LE 308767). **MONGOLIA. ARA-KHANGAI AIMAK:** watershed of Khukh-Sumein-Gol and Tsetserleg-Gol Rivers, Mt. Khairkhan, 47°15'N, 101°50'E, elev. 2400 m, 20.viii.1977, on *C. rangiferina* (moribund podetia), *L.G. Biazrov 6551a* (LE 308851a).

Specimens of Dactylospora rhyparizae *examined for comparison.* – **CANADA. NORTHWEST TERRITORIES:** Canadian Arctic Archipelago, Ellef Ringnes Island, Isachsen Bay, 78°47'N, 103°32'W, elev. 30 m, 23.vii.2005, on *Bryodina rhypariza* (thallus), *N.V. Matveeva s.n.* (LE 260409). **RUSSIA. KRASNOYARSK TERRITORY:** Putorana Plateau, Kapchuk Lake, taiga mountain belt, 11.viii.1982, on *B. rhypariza* (discs and margins of apothecia), *A.N. Titov s.n.* (LE 207216).

***Didymocyrtis cladoniicola* (Diederich, Kocourk. & Etayo) Ertz & Diederich**

NOTES. – This species is here reported for the first time from Asia, and *Cladonia subturgida* is reported as a new host species.

Specimens examined. – **SPAIN. CANARY ISLANDS:** La Gomera Island, Los Barranquillos, 28º9.125'N, 17º18.299'W, elev. 1015 m, 13.ii.2002, on *Cladonia cervicornis* (squamules), *F. Schumm s.n.* (H). **TOLEDO:** between Sevilleja de la Jara and Puerto Rey, 39º28'42"N, 5º00'12"W, elev. 900 m, 20.xii.2014, on *C. rangiformis* (podetia), *R. Pino-Bodas s.n.* (H); Minas de Santa Quiteria, 39º28'18"N, 4º59'27"W, elev. 1000 m, 20.xii.2014, on *C. subturgida* (basal squamules), *R. Pino-Bodas s.n.* (H); Cáceres, Losar de la Vera, 40º5'40.40"N, 5º33'13.8"W, 14.xii.2014, on *C. subturgida* (upper side of basal squamules), *R. Pino-Bodas s.n.* (H). **MONGOLIA. KHENTII AIMAK:** Gorchin-Ana, ca. 60 km NE of Ulan-Bator, ca. 48º05'N, 107º20'E, 20.vii.1978, on *C. pyxidata*, (basal squamules), *S. Huneck MVR-228a* (H).

***Didymocyrtis foliaceiphila* (Diederich, Kocourk. & Etayo) Ertz & Diederich**

NOTES. – In the material cited below the conidia measured (4.1–)5.3–6.5(–7.4) × (1.9–)2.1–2.5(–2.6) µm [l/b = (1.8–)2.3–2.9(–3.4) (n = 107)], which corresponds to the range of variation of conidial size given by Diederich et al. (2007). The species was previously known from Asia based on an uncertain report from Turkey (as 'aff. *foliaceiphila*'; Kocakaya et al. 2016). Here we report it as new to Finland and Russia. *Cladonia arbuscula*, *C. uncialis* and *C. uliginosa* are also new host species.

Specimens examined. – **FINLAND. UUSIMAA:** Vantaa, Koivukylä, 60°19'45"N, 25°02'19"E, elev. 32 m, 1.vi.2014, on *Cladonia arbuscula* (podetia), *R. Pino-Bodas s.n.* (H). **RUSSIA. KRASNODAR TERRITORY:** Caucasus, Mt. Armovka, 43°52'28"N, 40°39'20"E, elev. 2250 m, 31.viii.2014, on *C. uncialis* (podetia), *M.P. Zhurbenko 14282* (LE 308614). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Dal'negorsk, 44°35'48"N, 135°33'12"E, elev. 240 m, 18.viii.2013, on *C. uliginosa* (podetia including podetial squamules), *M.P. Zhurbenko 13173* (LE 308689).

Endophragmiella stordeuriana **U. Braun, Zhurb., Diederich, Tsurykau & Heuchert**

NOTES. – This is the second report of this species from Asia and Russia, it was found close to the type locality (Zhurbenko et al. 2015b). *Cladonia gracilis* is a new host species.

Specimen examined. – **RUSSIA. PRIMORYE TERRITORY:** Iman River, 3 km W of Glubinnoe (Sibichi), 46°04'N, 135°23'E, 31.viii.1946, on *Cladonia gracilis* (podetia), *M.V. & A.A. Korchaginy s.n.* (LE 308768b).

Epicladonia sandstedei **(Zopf) D. Hawksw.**

DESCRIPTION. – *Conidiomata* 50–150(–220) µm in diameter, immersed to almost sessile, sometimes gaping, with pore up to 80 µm in diameter, often extruding a white opaque droplet; wall reddish/orange-brown. *Conidiogenous cells* (9.0–)10.2–15.4(–18.0) × (2.0–)2.4–3.6(–4.3) µm (n = 37). *Conidia* oblong and usually slightly attenuated below, slightly clavate or subcylindrical, apex rounded, base broadly truncate, often slightly convex, sometimes with tiny marginal indentations of wall remnants, (6.9–)9.0–11.6(–16.7) × (2.5–)3.0–3.6(–5.1) µm, l/b = (1.8–)2.7–3.7(–5.4) (n = 712), (0–)1-septate (in some specimens up to 50% aseptate), not or rarely slightly constricted at the septum, guttulate, hyaline and smooth-walled or very rarely light brown and verruculose (evidently when overmature).

NOTES. – Hawksworth (1981) reported conidiomata of this species to be 50–80(–120) µm in diameter, and conidia to be (7.5–)9–12(–14) × (2.5–)3–4 µm in size, consistently hyaline and smooth-walled. Our material differs from the prior published description in having conidiomata that may be larger in diameter, and conidia that are usually smooth-walled and hyaline, but occasionally are also light-brown and verruculose when overmature. We found this species on the basal squamules and/or podetia of *Cladonia alaskana*, *C.* cf. *cenotea*, *C. chlorophaea*, *C. coniocraea*, *C. cornuta*, *C. crispata*, *C. fimbriata*, *C. gracilis* s. lat., *C. gracilis* ssp. *elongata*, *C. gracilis* ssp. *vulnerata*, *C. humilis* s. lat., *C. macilenta*, *C. nana*, *C. ochrochlora*, *C. pocillum*, *C. pyxidata*, *C. rei*, *C. stricta*, *C. subfurcata*, *C. subrangiformis*, *C. subulata*, *C. trassii*, *C. verticillata* and unidentified *Cladonia* species. Usually it induces galls on the host, but occasionally these are indistinct (e.g., in LE 309075, LE 308734). The taxon is widely distributed in the Holarctic including the tundra biome, but not known from the polar desert biome. Here we report the species for the first time from Kyrgyzstan, New Zealand and Macaronesia. *Cladonia alaskana*, *C. crispata*, *C. macilenta*, *C. nana*, *C. stricta*, *C. subfurcata*, *C. trassii* and *C. verticillata* are new host species.

Specimens examined. – **PORTUGAL. MADEIRA:** NW of Pico d Fonde do Bispo, 32°47.84'N, 17°10.88'W, elev. 1110 m, 2.v.2012, on *Cladonia nana*, *P.P.G. Van den Boom 47938a* (H). **SPAIN. TOLEDO:** between Sevilleja de la Jara and Puerto Rey, 39º28'42"N, 5º00'12"W, elev. 900 m, 20.vii.2014, on *C. humilis* s. lat. (basal squamules and podetia), *R. Pino-Bodas s.n.* (H). **BOSNIA AND HERZEGOVINA**. Ruište, 43°24'23"N, 18°00'35"E, elev. 110 m, 30.iii.2010, on *C. subrangiformis* (podetia), *A.R. Burgaz s.n.* (H). **LITHUANIA.** Asveja Regional Park, 55.073°N, 25.419°E, 22.ix.2011, on *C. rei* (podetia), *F. Högnabba 220911-15a* (H). **FINLAND. PÄIJÄNNE TAVASTIA:** Heinola, Keiö, 6.v.2010, on *C. coniocraea*, *V. Haikonen 27543a* (H). **RUSSIA. REPUBLIC OF ADYGEYA:** Caucasus, Mt. Tybga, 43°52'48"N, 40°15'59"E, elev. 2480 m, 7.viii.2014, on *Cladonia* sp. (podetia), *M.P. Zhurbenko 141* (LE 308482). **NENETS AUTONOMOUS AREA:** Bol'shezemel'skaya tundra, Khar'yaga oilfield, 67°11'N, 56º30'E, elev. 60 m, 24.vii.2007, on *C. gracilis* (podetia), *M.P. Zhurbenko 0739b* (LE 308553). **KRASNOYARSK TERRITORY:** Taimyr Peninsula, Uboinaya River, 73°39'N, 82°22'E, elev. 20 m, 3.viii.1990, on *C. trassii* (podetial squamules), *M.P. Zhurbenko 90385* (LE 308572); Taimyr Peninsula, Ragozinka River, 72°48'N, 80°53'E, elev. 5 m, 24.vii.1990, on *C. pocillum* (podetia and basal squamules), *M.P. Zhurbenko 90475* (LE 308561); Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°30'E, elev. 1450 m, 6.vii.2009, on *C. pocillum* (basal squamules, podetia), *M.P. Zhurbenko 0962* (LE 308663); 7.vii.2009, on *C. pocillum* (basal squamules, podetia), *M.P. Zhurbenko 0960* (LE 308661);

8.vii.2009, *M.P. Zhurbenko* 0952 (LE 308655); 14.vii.2009, *M.P. Zhurbenko 0955* (LE 308657), 20.vii.2009, *M.P. Zhurbenko* 0976 (LE 308676); 22.vii.2009, *M.P. Zhurbenko 0975* (LE 308675). **REPUBLIC OF BURYATIA:** SE coast of Baikal Lake, 5 km SW of Turka, 52°50'50"N, 108°00'50"E, elev. 460 m, 25.viii.2002, on *C. macilenta* (basal squamules, podetia), *M.P. Zhurbenko 02404* (LE 309084); Khamar-Daban Range, Chernoe Lake, 7.viii.1996, on *C. cornuta* (podetia), *I.N. Urbanavichene s.n.* (LE 308836); Khamar-Daban Range, Klyuchevaya River, 3.viii.1996, on *C. coniocraea* (basal squamules), *I.N. Urbanavichene s.n.* (LE 308770); Khamar-Daban Range, Mt. Osinovka, 51°30'N, 105°23'E, elev. 1300 m, 24.vi.1993, on *Cladonia* sp. (basal squamules), *I.N. Urbanavichene s.n.* (LE 308782). **KHABAROVSK TERRITORY:** Mt. Tabo, 51°37'55"N, 140°54'05"E, elev. 105 m, 6.viii.2011, on *C.* cf. *cenotea* (podetia), *L.S. Yakovchenko s.n.* (LE 308691b). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Kabanii Creek, 45°06'35"N, 135°52'01"E, elev. 490 m, 5.ix.2013, on *C. coniocraea* (podetia), *M.P. Zhurbenko 13165* (LE 308643); Sikhote-Alin' Range, Valinku River, 46.13474°N, 136.6867°E, elev. 1460 m, 27.viii.2013, on *Cladonia* sp. (basal squamules), *Yu.V. Gerasimova s.n.* (LE 308698). **CHUKOTKA AUTONOMOUS AREA:** Wrangel' Island, Klark River, 71º08'N, 178°16'W, 24.viii.1998, on *C. stricta* (podetia), *S.S. Kholod s.n.* (LE 308581); Provideniya, 64°27'N, 173°11'W, elev. 200 m, 23.viii.2001, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 0189* (LE 308559). **KYRGYZSTAN.** Alai Range, 19.viii.1979, on *C. pyxidata* (basal squamules, podetia), *L.I. Bredkina 3406* (LE 308857). **MONGOLIA. ARA-KHANGAI AIMAK:** watershed of Khukh-Sumein-Gol and Tsetserleg-Gol Rivers, Mt. Khairkhan, 47º15'N, 101º50'E, elev. 2300 m, 28.viii.1979, on *C. pyxidata*, *L.G. Biazrov s.n.* (H), 13.vii.1973, on *C. cornuta* (podetia), *L.G. Biazrov 2076* (LE 308872), 1.viii.1979, on *C. ochrochlora* (basal squamules, podetia), *L.G. Biazrov 6143* (LE 308870), 19.vi.1971, on *C. subfurcata* (podetia), *L.G. Biazrov 1741* (LE 308841); 14 km SE of Tevshrulekh, 22.vi.1976, on *Cladonia* sp. (podetia), *L.G. Biazrov 8572* (LE 308855). **BULGAN AIMAK:** Burgut Range, 48º30'N, 102º30'E, elev. 2000 m, 24.vii.1977, on *C. pyxidata* (basal squamules, podetia), *L.G. Biazrov s.n.* (LE 308873). **DZABKHAN AIMAK:** Tarbagatai Range, 48º15'N, 98º54'E, elev. 2450 m, 1.vii.1976, on *Cladonia* sp. (podetia), *L.G. Biazrov 2354* (LE 308863). **JAPAN, HOKKAIDO:** Mt. Dairoku, 1300 m, 1.ix.1972, on *C. gracilis* ssp. *elongata*, *T. Ahti 28955* (H). **U.S.A. ALASKA:** Seward Peninsula, 7 km NE of Nome, Newton Peak, 64°33'21"N, 165°21'23"W, elev. 220 m, 4.ix.2001, on *C. pyxidata* (basal squamules, podetia), *M.P. Zhurbenko 01644a* (LE 308594a); Blueberry Hill, 64.8919°N, 163.6470°W, elev. 113 m, 19.vii.2000, on *C. gracilis* (podetia), *D.A. Walker s.n.* (LE 309074); Kotzebue, 1961, on *C. pocillum* (basal squamules, podetia), *B. Neiland s.n.* (LE 309075); 66°53'N, 162°31'W, elev. 30 m, 19.viii.2000, on *Cladonia* sp. (podetia), *M.P. Zhurbenko 00172* (LE 309082); Selawik Wildlife Refuge, 28.vi.2008, on *C. gracilis* ssp. *vulnerata* (podetia), *G. Frost s.n.* (LE 308567); Tanana River, Bonanza Creek, 64°42.207'N, 148°18.937'W, elev. 140 m, 25.viii.2004, on *C. cornuta* (podetia), *M.P. Zhurbenko 04275b* (LE 309125b); Goldstream Valley, 64°57.188'N, 147°42.775'W, 31.vii.2004, on *C. cornuta* (podetia), *M.P. Zhurbenko 0470* (LE 309090); Skyline Ridge, 64°55.270'N, 147°43.001'W, elev. 470 m, 31.vii.2004, on *C. cornuta* (podetia), *M.P. Zhurbenko 0443* (LE 309086); Fairbanks, 64°52.741'N, 147°40.085'W, 4.viii.2004, on *C. furcata* (podetia), *M.P. Zhurbenko 0485* (LE 309088); 64°49.583'N, 147°45.513'W, 4.viii.2004, on *C. crispata* (podetia), *M.P. Zhurbenko 0487* (LE 309085); Denali National Park and Preserve, Rock Creek, 63°43.35'N, 148°57.53'W, elev. 650–700 m, 17.viii.2004, on *Cladonia* sp. (podetia), *M.P. Zhurbenko 04209b* (LE 309112b); on *C. subulata* (podetia), *M.P. Zhurbenko 04214b* (LE 309040b); on *C. alaskana* (podetia), *M.P. Zhurbenko 04215* (LE 309087); 20.viii.2004, on *C. pyxidata* (basal squamules, podetia), *M.P. Zhurbenko 04380* (LE 309089); on *C. gracilis* (podetia), *M.P. Zhurbenko 04164* (LE 309091); on *C. pyxidata* (basal squamules, podetia), *M.P. Zhurbenko 04189* (LE 309072); Anchorage, Ft. Richardson Army base, 61°15'N, 149°42'W, elev. 59 m, 17.vii.2000, on *Cladonia* sp. (podetia), *T. Jorgenson s.n.* (LE 308542); Prince of Wales Island, Salt Chuck mine, 55°37'28"N, 132°33'04"W, elev. 5 m, 7.viii.2001, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 01207* (LE 309081). **ARIZONA:** APACHE CO.: Mount Baldy Wilderness, 33°57'00"N, 109°31'30"W, 4.vii.1994, on *C. verticillata* (podetia), *T.H. Nash III 34946* (H, LE 260933). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Spahats Creek, 51°44'23"N, 120°00'23"W, elev. 770 m, 10.vii.2002, on *C. fimbriata* (podetia), *M.P. Zhurbenko 02244* (LE 308729); Mt. Raft, 51°44'N, 119°50'W, elev. 1800 m, 13.vii.2002, on *Cladonia* sp. (basal squamules, podetia), *M.P. Zhurbenko 02143* (LE 308735), on *Cladonia* sp. (podetia), *M.P. Zhurbenko 02189* (LE 308726); Philip Creek, 52°52'N, 120°00'W, elev. 800 m, 30.vii.2002, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 02403* (LE 308734); Columbia Mts., Beaver River, 51°18'N, 117°24'W, elev. 1100 m, 17.vii.2002, on *C. fimbriata* (podetia), *M.P. Zhurbenko 0278* (LE 308736); Columbia River Valley near mouth of Downie Creek, elev. 650 m, 20.vii.2002, on *C.* cf. *ochrochlora* (basal squamules, podetia), *M.P. Zhurbenko 0225a* (LE

308778a). **NEW ZEALAND. SOUTH ISLAND:** Fiordland National Park, Mt. Burns, 45.746°S, 167.380°E, elev. 1000 m, 8.v.2010, on *C. chlorophaea* (podetia), *S. Stenroos 5861b* (H).

***Epicladonia simplex* D. Hawksw.**

DESCRIPTION. – *Conidiomata* mainly semi-immersed, (30–)50–100(–150) μm in diameter, often gaping, with pore up to 50 μm in diameter extruding a white opaque droplet, dispersed to aggregated; wall blue green in the proximity of conidiogenous cells, otherwise olive to brown. *Conidiogenous cells* occasionally with up to 4 annellations. *Conidia* hyaline, fusiform to occasionally almost oblong, apex rounded, base truncate (sometimes indistinctly), (6.4–)7.3–8.5(–9.5) × (2.0–)2.4–2.8(–3.5) μm, l/b = (2.3–)2.7–3.3(–4.0) (n = 103), aseptate, smooth-walled, occasionally passively attached in short "false chains".

NOTES. – There are some discrepancies between our material and the protologue (Hawksworth 1981) where the conidia were reported as being slightly longer, (8.5–11(–12) × 2.5–3(–3.5) μm), and the excipular pigments only brown. It is noteworthy that Ihlen and Wedin (2006) also observed both brown and olivaceous green pigmentation of the pycnidial wall. According to the protologue, the species usually induces galls, but in the examined material they were observed only in LE 308685. The species has been found on the apothecia, podetia and/or basal squamules of *Cladonia botrytes* and *C. coccifera.* Most specimens were collected on epiphytic *Cladonia botrytes*, which corresponds to the observations of Ihlen and Wedin (2006).

Specimens examined. – **FINLAND. SATAKUNTA:** Teikangas, 61°47'14"N, 22°59'02"E, elev. 120 m, 15.vi.2013, on *Cladonia botrytes* (apothecia), *T. Ahti 72075a* (H). **RUSSIA. TYUMEN' REGION:** Polar Ural, Mt. Rai-Iz, 66°50'N, 65°05'E, elev. 580 m, 10.ix.2001, on *C. coccifera* (basal and podetial squamules), *S.S. Kholod s.n.* (LE 308573). **KRASNOYARSK TERRITORY:** Western Sayan Mts., Ergaki Nature Park, Bol'shaya Baklanikha River, 52°46'N, 93°19'E, elev. 1150 m, 24.vii.2010, on *C. botrytes* (hymenium, occasionally podetia), *M.P. Zhurbenko 1050* (LE 308685); Turukhansk Region, Zotino, 61ºN, 89º50'E, elev. 100 m, 21.viii.1979, on *C. botrytes* (basal squamules), *V.B. Kuvaev s.n.* (LE 308924b). **REPUBLIC OF BURYATIA:** Khamar-Daban Range, Vydrinaya River, 31.vii.1996, on *C. botrytes* (basal squamules), *I.N. Urbanavichene s.n.* (LE 308792). **SAKHALIN REGION:** Sakhalin Island, Palevo, 50°37'N, 142°43'E, 20.ix.2008, on *C. botrytes* (apothecia), *N.A. Tsarenko s.n.* (LE 309076).

***Epicladonia stenospora* (Harm.) D. Hawksw. s. lat.**

DESCRIPTION. – *Conidiomata* 40–130 μm in diameter, first immersed and later partly erumpent, dispersed; wall with brown pigments. Annellations of *conidiogenous cells* not observed. *Conidia* hyaline, narrowly ellipsoid, oblong or slightly narrowly ovoid, occasionally rather irregular in shape, for instance constricted in the middle, sometimes slightly attenuated below, apex rounded to occasionally slightly acute, base narrowly truncate, (5.3–)6.9–9.1(–14.4) × (2.3–)3.1–3.9(–4.6) μm, l/b = (1.4–)2.0–2.6(–3.5) μm (n = 323), only aseptate conidia observed.

NOTES. – According to Sérusiaux et al. (2003) this species may be heterogenous; for instance, the shape of the conidia in neotype differ from those depicted by Hawksworth (1981: Fig. 9), the former being always narrower in the middle, while the latter are broader in the middle. The conidia of the neotype are 9–10 × 3.5–4 μm in size, and 0(–1)-septate (Sérusiaux et al. 2003). We found the species on the basal squamules and/or podetia of *Cladonia amaurocraea*, *C. angustiloba*, *C. cenotea*, *C. chlorophaea*, *C. pyxidata*, *C. squamosa* and *Cladonia* spp. Distinct gall formation was not observed, although infected host thalli were rarely somewhat swollen and/or slightly discolored. Here we report the species as new to Portugal, Mongolia and Macaronesia. *Cladonia angustiloba*, *C. cenotea* and *C. squamosa* are also reported as new host species.

Specimens examined. – **PORTUGAL. AZORES ISLANDS:** Pico Island, Porto do São Caetano, 38°25'33"N, 28°25'39"W, elev. 30 m, 27.ii.2015, on *Cladonia angustiloba* (basal squamules), *R. Pino-Bodas s.n.* (H). **RUSSIA. MURMANSK REGION:** Dal'ne-Zelenetskaya Bay, 69°07'N, 36°05'E, elev. 20 m, 22.viii.1997, on *Cladonia* sp. (basal and podetial squamules), *M.P. Zhurbenko 97414* (LE 308911). **LENINGRAD REGION:** Vuoksa Lake, 3.5 km NW of Priozersk, 61°04'55"N, 29°59'38"E, 17.vii.2012, on *Cladonia* sp. (podetia), *M.P. Zhurbenko 02200* (LE 308756). **NENETS AUTONOMOUS AREA:**

Bol'shezemel'skaya tundra, Ortin River, 67°49'25"N, 54°00'07"E, 30.vi.1999, on *C. squamosa* (podetia), *O.V. Lavrinenko s.n.* (LE 308929). **KHABAROVSK TERRITORY:** Mt. Tabo, 51°37'55"N, 140°54'05"E, elev. 105 m, 6.viii.2011, on *Cladonia* sp. (podetia), *L.S. Yakovchenko s.n.* (LE 308690). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Zabolochennaya River, 45°13'42.8"N, 136°31'04.5"E, elev. 150 m, 26.viii.2013, on *C. cenotea* (podetia), *M.P. Zhurbenko 13139* (LE 308483). **CHUKOTKA AUTONOMOUS AREA:** Lavrentiya Bay, 65°31'N, 170°59'W, 22.viii.1975, on *C. amaurocraea* (podetia), *I.I. Makarova s.n.* (LE 308827). **MONGOLIA. ARA-KHANGAI AIMAK:** Khukh-Sum-Gol River, 47°15'N, 101°50'E, elev. 2000 m, 20.vii.1975, on *Cladonia* sp. (basal squamules), *L.G. Biazrov 1051* (LE 308877). **U.S.A. ALASKA:** Kotzebue, 1961, on *Cladonia* sp. (podetia), *B. Neiland s.n.* (LE 309077); Denali National Park and Preserve, 63°43.35'N, 148°57.53'W, elev. 650 m, 20.viii.2004, on *C. pyxidata* (basal squamules), *M.P. Zhurbenko 04188c* (LE 309045c); Aleutian Islands, Adak Island, Clam Lagoon, 51°57'04"N, 176°34'05"W, elev. 12 m, 26.viii.2013, on *C. chlorophaea* (basal squamules), *S. Talbot & S. Talbot ADA702a* (H).

***Epigloea soleiformis* Döbbeler**

NOTES. – The species has been reported from algal films over moribund bryophytes, detritus, humus, rotten wood, tree bark, rock and decaying terricolous lichen species of the genera *Cladonia*, *Peltigera*, *Placynthiella* and *Stereocaulon* (Berger 2000, Chambers & David 2009, Döbbeler 1984, Suija et al. 2010, Zhurbenko 2010b). It is not lichenized in the classic sense, nor is it truly lichenicolous. Nonetheless we include it here for completeness. The species was previously known in Russia also from Southern Siberia (Zhurbenko 2010b); we provide two additional records here.

Specimens examined. – **RUSSIA. KRASNOYARSK TERRITORY:** Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°32'E, elev. 1500 m, 22.vii.2009, on algal films over moss remnants and *Cladonia coccifera* (moribund basal squamules and podetia), *M.P. Zhurbenko 0969* (LE 308670). **TRANS-BAIKAL TERRITORY:** Kodar Range, Surpriznoe Lake, 56°54'21"N, 117°38'20"E, elev. 2011 m, 5.vii.2013, on *Cladonia* sp. (moribund thallus), *L.A. Konoreva s.n.* (LE 309280).

***Hainesia brevicladoniae* Diederich & Van den Boom**

DESCRIPTION. – *Conidiomata* olive brown to dark brown or almost black, glossy, superficial, 40–220 µm in diameter, initially pyriform or subglobose, sometimes with papillae, almost closed, later hemispherical to cupulate, with a wide opening. *Conidia* hyaline, bacilliform, (10.4–)12.4–16.0(–20.7) × (1.0–)1.2–1.6(–1.7) µm, l/b = (6.3–)8.2–12.0(–15.8) (n = 89), (0–)1(–3)-septate.

NOTES. – In the protologue the conidia were reported as being aseptate and somewhat thinner than in the specimens we examined [(13.5–)15.3–17.5(–18.0) × (1.0–)1.0–1.1(–1.2) µm, l/b = (11.5–)14.0–16.9(–17.5)] (Diederich & Van den Boom 2013). P. Diederich (pers. comm., 2015) has revised the holotype and confirmed that the conidia are septate. This species was formerly known in Russia only from the Caucasus (Zhurbenko & Kobzeva 2014) and we here report it from two new locations. *Cladonia coniocraea* is also a new host species.

Specimens examined. – **RUSSIA. PRIMORYE TERRITORY:** Sikhote-Alin' Range, Kabanii Creek, 45°06'35"N, 135°52'01"E, elev. 490 m, 5.ix.2013, on *Cladonia coniocraea* (podetia), *M.P. Zhurbenko 13167b* (LE 309176). **SAKHALIN REGION:** Sakhalin Island, Mt. Bol'shevik near Yuzhno-Sakhalinsk, 46°57'N, 142°47'E, elev. 800 m, 13.x.1996, on *C. gracilis* (podetia), *A.A. Dobrysh s.n.* (LE 308826).

***Hainesia* cf. *bryonorae* Zhurb.**

NOTES. – In the specimens that we examind the conidiomata measured (60–)100–150(–190) µm in diameter (n = 50). The conidia were hyaline, bacilliform to filiform, (14.4–)17.4–22.4(–28.5) × (1.0)1.1–1.3(–1.7) µm in size [l/b = (12.8–)14.3–19.7(–22.2) (n = 104)], and primarily (0–)1-septate, rarely up to 3-septate. The examined material agrees well with the protologue (Zhurbenko & Brackel 2013), including the size of conidia [(12.0−)18.1−24.5 (−29.1) × (1.1−)1.3−1.5 (−1.6) µm]. However, the conidiomata are larger than was originally reported (30−100 µm in diameter), and the species was described from a different host (*Bryonora*, Lecanoraceae, in the same order Lecanorales). Nonetheless, some lichenicolous species of *Hainesia* are known to demonstrate low host specificity. For instance *H.*

xanthoriae Brackel was reported on lichens from the orders Lecanorales and Peltigerales (Brackel 2014). Compared to the *Hainesia* species described from *Cladonia*, the examined material is most similar to *H. brevicladoniae*, which mainly differs in having shorter conidia (see notes on this species above). *Hainesia bryonorae* was described from the tundra and polar desert biomes of Svalbard and the Canadian Arctic archipelago, growing on the hymenium of apothecia of terricolous *Bryonora castanea* (Zhurbenko & Brackel 2013).

Specimens examined. – **NORWAY. SVALBARD:** Aldegondabreen Glacier, 78°00'N, 14°12'E, elev. 100 m, 16.vii.2003, on *Cladonia* sp. (moribund bleached podetia), *M.P. Zhurbenko 03453* (LE 308501). **RUSSIA. KRASNOYARSK TERRITORY:** Taimyr Peninsula, Ragozinka River, 72°48'N, 80°53'E, elev. 5 m, 4.vii.1990, on *C. macroceras* (podetial squamules), *M.P. Zhurbenko 90100* (LE 308576).

***Hainesia longicladoniae* Diederich & Van den Boom**

NOTES. – In the specimens examined the conidiomata measured 60–100 µm in diameter. The conidia were hyaline, filiform, mainly 3–6-septate, and 35–50 × 1.5–2 µm in LE 308594b or (52.5–)58.0–71.0(–74.5) × (1.5–)1.6–1.8(–2.0) µm, l/b = (29.2–)33.0–42.4(–46.5) (n = 18) in LE 308828. Originally the conidia of the species were reported as being aseptate, but later P. Diederich (pers. comm., 2015) revised the holotype and confirmed that they are septate. In the protologue the conidia were stated to measure (28.0–)40.1–63.5(–69.0) × (1.0–)1.1–1.4(–1.6) µm, l/b = (23.7–)33.6–49.8(–61.8) which agrees well with our material (Diederich & Van den Boom 2013). Here we report *Hainesia longicladoniae* for the first time from Asia and North America, as well as Russia. *Cladonia coccifera* and *C. pyxidata* are new host species.

Specimens examined. – **RUSSIA. KRASNOYARSK TERRITORY:** Taimyr Peninsula, Enisey Bay, Sibiryakova Island, 72°50'N, 79°10'E, 22.vii.1989, on *Cladonia coccifera* (blackened hymenium of apothecia), *V.B. Kuvaev 1307* (LE 308828). **U.S.A. ALASKA:** Seward Peninsula, 7 km NE of Nome, Newton Peak, 64°33'21"N, 165°21'23"W, elev. 220 m, 4.ix.2001, on *C. pyxidata* (basal squamules, podetia), *M.P. Zhurbenko 01644b* (LE 308594b).

***Heterocephalacria bachmannii* (Diederich & M.S. Christ.) Millanes & Wedin**

NOTES. – In the specimens we examined the basidiospores measured (6.0–)7.2–9.2(–11.0) × (3.9–)4.6–5.8(–6.8) µm, l/b = (1.3–)1.4–1.8(–2.0) (n = 92, in water or K). Asteroconidia (found in LE 308608, LE 308758 and LE 309190a) are reported here for the first time for this species (Diederich 1996), lunate conidia (found in LE 308547, LE 308541, LE 308548, LE 309186, LE 309188, LE 308740a and LE 309202) are quite common. The species was found on podetia (mainly on their tips) and sometimes on basal squamules of *Cladonia acuminata*, *C. amaurocraea*, *C. cervicornis*, *C. chlorophaea* s. lat., *C. coniocraea*, *C. cornuta*, *C. ecmocyna*, *C. foliacea*, *C. furcata*, *C. glauca*, *C. gracilis* s. lat., *C. gracilis* ssp. *turbinata*, *C. gracilis* ssp. *vulnerata*, *C. macroceras*, *C. macrophylla*, *C.* cf. *pleurota*, *C. pocillum*, *C. pyxidata*, *C. rangiferina*, *C. stereoclada*, *C. stygia*, *C. subulata*, *C. sulphurina*, *C. uliginosa*, *C. umbricola*, *C. verticillata* and unidentified *Cladonia* species. Infected parts of the host are usually contorted or otherwise deformed. This taxon is widely distributed in the Holarctic including the tundra biome, but here we report it new to the polar desert biome. *Cladonia acuminata*, *C. amaurocraea*, *C. cervicornis*, *C. foliacea*, *C. glauca*, *C. pocillum*, *C. stereoclada*, *C. stygia*, *C. sulphurina* and *C. uliginosa* are new host species.

Specimens examined. – **PORTUGAL. AZORES ISLANDS:** Flores Island, Ponta Delgada, 39°29'17"N, 31°11'00"W, elev. 580 m, 4.iii.2015, on *Cladonia stereoclada* (podetia), *R. Pino-Bodas s.n.* (H); Pico Island, Cabeço Gordo, 38°29'15"N, 28°27'19"W, elev. 680 m, 28.ii.2015, on *C. stereoclada* (podetia), *R. Pino-Bodas s.n.* (H). **SPAIN. TOLEDO:** Navaltoril, 39°33'45"N, 4°47'56"W, 1.viii.2015, on *C. glauca* (podetia), *R. Pino-Bodas s.n.* (H); Zaragoza, Vera de Moncayo, 41°48'51"N, 1°43'24"W, elev. 650 m, 7.vii.2014, on *C. foliacea* (squamules), *R. Pino-Bodas s.n.* (H). **FINLAND. KANTA-HÄME:** Tammela, Torronsuo National Park, 60°44'N, 23°43'E, 31.xi.2014, on *C. stygia* (podetia), *R. Pino-Bodas s.n.* (H). **RUSSIA. REPUBLIC OF ADYGEYA:** Caucasus, Guzeripl', 43°59'25"N, 40°08'56"E, elev. 770 m, 13.viii.2014, on *C. coniocraea* (basal squamules, podetia), *M.P. Zhurbenko 14277a* (LE 308608). **KRASNODAR TERRITORY:** Caucasus, Lagonaki Upland, Mt. Fisht, 43°57'46"N, 39°55'36"E, elev.

1600 m, 23.viii.2014, on *C. pyxidata* (basal squamules, podetia), *M.P. Zhurbenko 14298a* (LE 309190a); Mt. Armovka, 43°53'27"N, 40°39'47"E, elev. 1830 m, 30.viii.2014, on *C. coniocraea* (basal squamules, podetia), *A.A. Kobzeva 1481b* (LE 309189). **NENETS AUTONOMOUS AREA:** Bol'shezemel'skaya tundra, Khar'yaga oilfield, 67°14'22"N, 56°38'55"E, elev. 70 m, 20.vii.2007, on *C. furcata* (podetia), *M.P. Zhurbenko 0734* (LE 309312); Cape Bolvanskii Nos, 68°18'N, 54°30'E, 20.vii.1999, on *C. macroceras* (podetia), *O.V. Lavrinenko s.n.* (LE 309193). **KOMI REPUBLIC:** Northern Ural, Yanypupuner Range, 62°04'N, 59°08'E, elev. 500 m, 4.vii.1997, on *C. macrophylla* (podetia), *M.P. Zhurbenko 97404* (LE 308555). **KRASNOYARSK TERRITORY:** Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°26'E, elev. 1400 m, 19.vii.2009, on *C. furcata* (podetia), *M.P. Zhurbenko 0950* (LE 309204). **ALTAI TERRITORY:** Malyi Tigirek River, 51°09'N, 83°04'E, 12.vi.1996, on *C. pyxidata* (podetia), *E.A. Davydov s.n.* (LE 308547). **REPUBLIC OF BURYATIA:** Khamar-Daban Range, Mishikha River, elev. 460 m, viii.1995, on *C. verticillata* (podetia), *I.N. Urbanavichene s.n.* (LE 309198); Dzherginskii Reserve, Balan-Tamur Lake, 55°13'42"N, 111°41'57"E, 19.vii.2000, on *C. sulphurina* (podetia) over mossy boulder, *T.M. Kharpukhaeva s.n.* (LE 309185); Levye Kovyli River, 55°07'59"N, 111°28'04"E, 15.vii.2002, on *C. uliginosa* (podetia), *T.M. Kharpukhaeva s.n.* (LE 309180). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, 2 km N of Yasnaya cabin, 45°15'13"N, 136°30'10"E, elev. 180 m, 27.viii.2013, on *C. cervicornis* (podetia, mainly their tips), *M.P. Zhurbenko 13136* (LE 309182); Zabolochennaya River, 45°13'43"N, 136°31'05"E, elev. 150 m, 26.viii.2013, on *C. amaurocraea* (podetia, mainly their tips), *M.P. Zhurbenko 13168* (LE 309178); on *Cladonia* sp. (podetia, mainly their tips), *M.P. Zhurbenko 13169* (LE 309177); Golubichnaya River mouth, 44°54'20"N, 136°31'58"E, elev. 5 m, 3.ix.2013, on *C. cervicornus* (podetia), *M.P. Zhurbenko 13142* (LE 309192). **KAMCHATKA TERRITORY:** Kamchatka Peninsula, Kronotsky Nature Reserve, Levaya Schapina River, 55°08'29"N, 159°58'17"E, elev. 340 m, 12.viii.2009, on *C. gracilis* ssp. *turbinata* (podetia, mainly on their tips), *D.E. Himelbrant & I.S. Stepanchikova s.n.* (LE 308541). **CHUKOTKA AUTONOMOUS AREA:** Sireniki, 64°25'N, 173°57'W, 18.vii.1984, on *C. furcata* (podetia), *A.E. Katenin s.n.* (LE 309201), 23.vii.1986, *A.E. Katenin s.n.* (LE 309200); Lorino, 65°29'N, 171°43'W, 9.vii.1972, on *C. furcata* (podetia), *I.I. Makarova s.n.* (LE 309199); Puoten, 65°50'N, 170°32'W, 19.vii.1972, on *C. furcata* (podetia, mainly their tips), *I.I. Makarova s.n.* (LE 309203). **U.S.A. ALASKA:** Seward Peninsula, 7 km NE of Nome, Newton Peak, 64°33'N, 165°22'W, elev. 250 m, 5.ix.2001, on *C. furcata* (podetia), *M.P. Zhurbenko 0192* (LE 308548); 4.ix.2001, on *C. gracilis* ssp. *vulnerata* (podetia, mainly their tips), *M.P. Zhurbenko 0197b* (LE 308593b); Kotzebue, 66°53'N, 162°31'W, elev. 30 m, 19.viii.2000, on *C. gracilis* ssp. *vulnerata* (podetia), *M.P. Zhurbenko 00233a* (LE 309183); Great Kobuk Sand Dunes, 67°02'N, 158°50'W, elev. 50 m, 1.viii.2000, on *C. pocillum* (podetia), *M.P. Zhurbenko 00456* (LE 308556); 67°08'N, 159°03'W, elev. 65 m, 15.viii.2000, on *C. gracilis* (podetia), *M.P. Zhurbenko 00132* (LE 309205); Tanana River, Bonanza Creek, 64°51.32'N, 147°49.18'W, elev. 150 m, 25.viii.2004, on *C. pyxidata* (podetia, occasionally basal squamules), *M.P. Zhurbenko 04287* (LE 309184); 21.vii.2004, on *C. rangiferina* (podetia, mainly their tips), *M.P. Zhurbenko 04262* (LE 309181); Denali National Park and Preserve, Rock Creek, 63°43.35'N, 148°57.53'W, elev. 650 m, 16.viii.2004, on *C. acuminata* (podetia), *M.P. Zhurbenko 04195* (LE 309186); Tongass National Forest, Laughton cabin, 59.5450°N, 135.0907°W, 6.vi.2009, on *C. cornuta* (podetia), *K. Dillman 2009-150* (LE 308549); Kenai Peninsula, Chugach National Forest, 60°10'N, 149°30'W, elev. 150 m, 1.ix.2000, on *Cladonia* sp. (podetia), *M.P. Zhurbenko 00481* (LE 309188). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Philip Creek, 52°52'N, 120°00'W, 30.vii.2002, on *C. chlorophaea* s. lat. (podetia), *M.P. Zhurbenko 02154a* (LE 308740a); Mt. Raft, 51°44'N, 119°50'W, elev. 1800 m, 13.vii.2002, on *C. ecmocyna* (podetia, mainly their tips), *M.P. Zhurbenko 02142* (LE 308757); Spahats Creek, 51°44'23"N, 120°00'23"W, elev. 770 m, 10.vii.2002, on *C. cornuta* (basal squamules, podetia), *M.P. Zhurbenko 02280a* (LE 308806a); Philip Creek, 52°52'N, 120°00'W, elev. 800 m, 30.vii.2002, on *C. subulata* (podetia), *M.P. Zhurbenko 02161* (LE 308758); Edgewood, 51°52'N, 120°01'W, elev. 700 m, 1.viii.2002, on *C.* cf. *pleurota* (basal squamules, podetia), *M.P. Zhurbenko 02204* (LE 309179); Columbia Mts., Beaver River, 51°15'N, 117°22'W, elev. 1150 m, 17.vii.2002, on *C. umbricola* (podetia, occasionally basal squamules), *M.P. Zhurbenko 02100d* (LE 309202); Mount Revelstoke National Park, elev. 700 m, 18.vii.2002, on *C. pocillum* (basal squamules, podetia), *M.P. Zhurbenko 0243a* (LE 308737a).

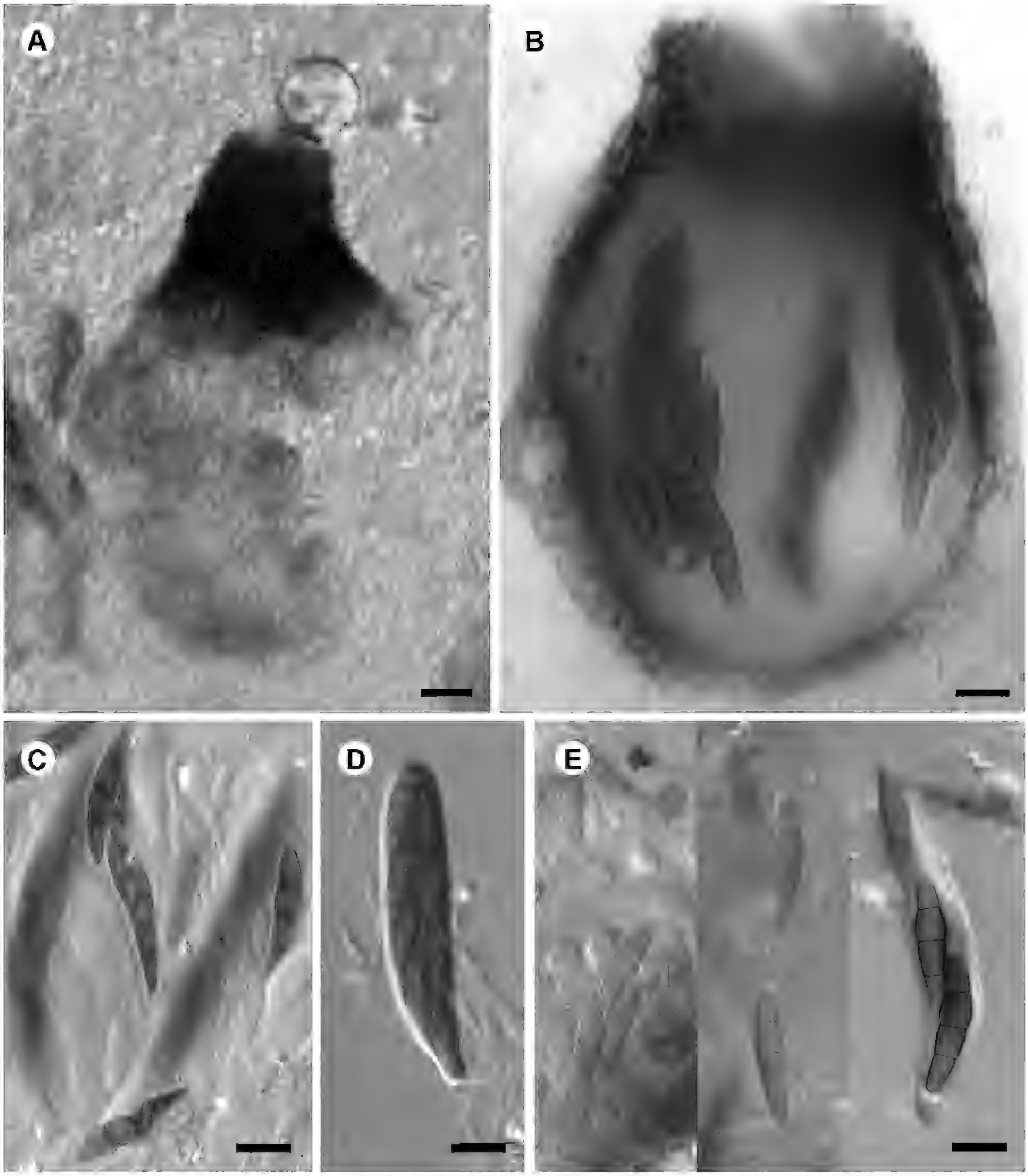

Figure 6. *Leptosphaeria* sp. growing on *Cladonia pocillum* (all from LE 210334). **A,** squashed section of ascoma in water, showing dark neck. **B,** ascoma in cross section in K. **C,** interascal hyphae in K. **D,** ascus with spores in I. E, ascospores in water (left) and K (right). Scale bars: A = 50 μm, B–E = 10 μm.

***Leptosphaeria* sp.**

FIGURE 6

DESCRIPTION. – *Ascomata* perithecia, pyriform with a neck 40–70 μm tall, 100–130 μm in diameter, 200–250 μm tall including the neck, completely immersed and visible as black dots ca. 50 μm in diameter or with upper part of the neck protruding above the host thallus; scattered. *Exciple* dark brown above, light brown below, K+ olive; in surface view of *textura angularis*, in vertical section ca. 7–8 μm thick, composed of 3–4 layers of tangentially strongly compressed cells. *Hymenial gel* I and K/I–.

Interascal hyphae difficult to observe, septate, often markedly constricted at the septa, 1.5–6 µm in diameter. *Asci* subcylindrical, (55–)60–80(–85) × 11–14(–15) µm (n = 13, in K, I or K/I), with short foot, tholus 1.5–4.5 µm tall, with ocular chamber up to 2 µm tall, 8-spored, I and K/I–. *Ascospores* medium yellow or light yellowish-brown, broadly fusiform or somewhat clavate, the penultimate cell broadest, (16.3–)16.4–24.2(–28.0) × (4.3–)4.6–5.4(–6.2) µm, l/b = (3.3–)3.4–4.6(–5.4) (n = 40, in water or I), transversally (1–)3-septate, usually distinctly constricted at the median septum, wall ca. 0.5 µm thick, finely verruculose, without gelatinous sheath, overlappingly biseriate in the ascus.

NOTES. – The examined material matches relatively well the protologue of *Leptosphaeria clarkii* D. Hawksw., a species so far known from two finds in England and Austria, growing on decaying thalli of *Peltigera praetextata* and *P.* cf. *rufescens*. However that species has smooth-walled and somewhat shorter ascospores [19–21(–22) × 4.5–6(–6.5) µm; Hawksworth 1980, Kaufmann & Hofmann 1998]. The material also resembles *Didymocyrtis ramalinae* (Desm.) Ertz, Diederich & Hafellner, and more generally fits the description of *Didymocyrtis* Vain. given in Ertz et al. (2015). It is also similar to *Leptosphaeria protousneae* Etayo. Nonethless both of those species differ in having larger ascomata, longer asci and shorter ascospores up to 20 µm long (Ertz et al. 2015, Etayo & Sancho 2008).

Specimen examined. – **NORWAY. SVALBARD:** Spitsbergen, Bünsow Land, NE extremity of Billefjorden near Kapp Napier, Norddammen Lake near Brucebyen cabin, 78°38'N, 16°44'E, tundra, 5.vii.2003, on *Cladonia pocillum* (moribund/bleached basal squamules), *M.P. Zhurbenko 03234* (LE 210334).

***Lichenoconium aeruginosum* Diederich, M.Brand, Van den Boom & Lawrey**

NOTES. – Previously this species has only been reported from Western Europe (Lawrey et al. 2011) and Turkey (Kocakaya et al. 2016). Here we report it as new to Spain. *Cladonia chlorophaea* is also a new host species.

Specimen examined. – **SPAIN. Zaragoza:** Vera de Moncayo, 41°48'51"N, 1°43'23"W, 650 m, 7.vii.2014, on *Cladonia chlorophaea* (podetia and basal squamules), *R. Pino-Bodas s.n.* (H).

***Lichenoconium erodens* M.S. Christ. & D. Hawksw.**

NOTES. – This is a widely distributed and common parasite reported from various lichen genera (Brackel 2014). *Cladonia coccifera* is a new host species.

Specimens examined. – **SPAIN. TOLEDO:** Aldeanueva de Barbarroya, Uso River, 39°42'04"N, 5°05'09"W, 28.xii.2014, on *Cladonia coccifera* (podetia), *R. Pino-Bodas s.n.* (H). **RUSSIA. PRIMORYE TERRITORY:** Sikhote-Alin' Range, Dal'negorsk, 44°31'39"N, 135°33'23"E, elev. 230 m, 17.viii.2013, on *C. gracilis* (podetia), *M.P. Zhurbenko 13154* (LE 308631).

***Lichenoconium pyxidatae* (Oudem.) Petr. & Syd.**

NOTES. – In the specimens examined the conidiogenous cells measured (5.0–)6.4–9.0(–11.4) × (1.7–)2.2–2.8(–3.4) µm (n = 75, in water or K), and were occasionally brown around the apices. The conidia were light to sometimes medium yellowish-brown (pale when aggregated in masses), occasionally subhyaline, quite often obovoid, attenuated and truncated at the base, and measured (2.2–)2.7–3.7(–6.9) × (1.8–)2.2–2.6(–3.5) µm, l/b = (1.0–)1.1–1.5(–2.8) (n = 279), with indistinctly verruculose walls. Morphologically, the species concepts of *Lichenoconium pyxidatae* and *L. usneae* are quite close, which made it impossible to identify some specimens with certainty. Our assignment to *L. pyxidatae* was thus based on the host in such cases. The species was found on podetia (often on the margins of scyphi) and/or sometimes basal squamules of *Cladonia chlorophaea* s. lat., *C. coniocraea*, *C. deformis*, *C. macrophylla*, *C. pocillum*, *C. pyxidata* and unidentified *Cladonia* species. Occasionally, it was associated with bleached parts of host thalli. *Cladonia deformis* and *C. macrophylla* are new host species.

Specimens examined. – **RUSSIA. REPUBLIC OF ADYGEYA:** Caucasus, Mt. Ekspeditsiya, 43°54'48"N, 40°15'43"E, elev. 1950 m, 9.viii.2014, on *Cladonia pyxidata* (upper margins of scyphi), *M.P. Zhurbenko 14278* (LE 308609). **KRASNODAR TERRITORY:** Caucasus, Mt. Armovka, 43°53'27"N, 40°39'47"E, elev. 1830 m, 29.viii.2014, on *C. coniocraea* (moribund podetium), *M.P. Zhurbenko 14280*

(LE 308611); Lagonaki Upland, Mt. Fisht, 43°57'08"N, 39°55'42"E, elev. 1640 m, 18.viii.2014, on *C. pocillum* (basal squamules, podetia), *M.P. Zhurbenko 14281* (LE 308612). **KOMI REPUBLIC:** Northern Ural, Yanypupuner Range, 62°04'N, 59°07'E, elev. 550 m, 4.vii.1997, on *C. pyxidata* (upper margins of scyphi), *M.P. Zhurbenko 97407* (LE 308898), 5.vii.1997, on *C. pocillum* (moribund podetia), *M.P. Zhurbenko 97401* (LE 308518). **KRASNOYARSK TERRITORY:** Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°31'E, elev. 1450 m, 24.vii.2009, on *C. macrophylla* (basal squamules, podetia), *M.P. Zhurbenko 0944* (LE 308651). **CHUKOTKA AUTONOMOUS AREA:** Lavrentiya Bay, 65°31'N, 170°59'W, 22.viii.1975, on *C. pyxidata* (scyphi), *I.I. Makarova s.n.* (LE 308824); Kurupka River, 64°45'N, 174°05'W, 21.viii.1987, on *C. pyxidata* (podetia), *A.E. Katenin s.n.* (LE 308812). **U.S.A. ALASKA:** Fairbanks, 64°49.583'N, 147°45.513'W, 9.viii.2004, on *C. chlorophaea* s. lat. (podetia), *M.P. Zhurbenko 04122* (LE 309097); Kenai Peninsula, Chugach National Forest, 60°10'N, 149°30'W, elev. 150 m, 1.ix.2000, on *Cladonia* sp. (podetia), *M.P. Zhurbenko 00269* (LE 309098). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Clearwater River, 51°43'16"N, 120°01'25"W, elev. 550 m, 14.vii.2002, on *C. deformis* (podetia), *J. Miadlikowska s.n.* (LE 308759a).

***Lichenoconium usneae* (Anzi) D. Hawksw.**

NOTES. – In our material the conidiogenous cells measured (7.2–)8.0–10.0(–11.7) × (2.0–)2.5–3.5(–4.0) µm (n = 27), and were sometimes brown around the apices. The conidia were light to mainly medium brown (never dark in mass), usually distinctly verruculose by light microscopy, mainly subglobose, sometimes obovoid, occasionally attenuated and truncated at the base, and measured (3.0–)3.3–4.1(–6.0) × (2.3–)2.7–3.3(–3.8) µm, l/b = 1.0–1.4(–2.0) (n = 126). It was found on the podetia, and/or occasionally apothecia and basal squamules of *Cladonia cervicornis* ssp. *mawsonii*, *C. chlorophaea* s. lat., *C. coniocraea*, *C. fimbriata*, *C. foliacea*, *C. intermediella*, *C. mitis*, *C. pocillum*, *C. pyxidata*, *C. rangiferina* and *C. sulphurina*. Infected parts of the host were only occasionally slightly bleached. The species was previously known in Africa only from the Canary Islands (Hawksworth 1981). *Cladonia cervicornis* ssp. *mawsonii*, *C. coniocraea*, *C. fimbriata*, *C. foliacea*, *C. intermediella*, *C. pocillum*, *C. rangiferina* and *C. sulphurina* are new hosts.

Specimens examined. – **SPAIN. CÁCERES:** Gamonoso, 39º23'52"N, 4º52'18"W, 20.xii.2014, on *Cladonia foliacea* (apothecia), *R. Pino-Bodas s.n.* (H). **LITHUANIA.** Asveja Regional Park, 55.073°N, 25.419°E, 22.ix.2011, on *C. fimbriata* (apothecia), *F. Högnabba 220911-15b* (H). **RUSSIA. KRASNODAR TERRITORY:** Caucasus, Mt. Armovka, 43°54'18"N, 40°39'43"E, elev. 1700 m, 1.ix.2014, on *C. chlorophaea* s. lat. (tips of podetia), *M.P. Zhurbenko 14481b* (LE 309449b); Mt. Yatyrgvarta, 43º54'33"N, 40º39'54"E, elev. 1650 m, 30.viii.2014, on *C. coniocraea* (podetia and galls induced by *Heterocephalacria bachmannii*), *A.A. Kobzeva 1481a* (LE 308613). **KRASNOYARSK TERRITORY:** Taimyr Peninsula, Levinson-Lessinga Lake, 74°24'N, 98°49'E, elev. 100 m, 29.vii.1995, on *C. rangiferina* (podetia), *M.P. Zhurbenko 95603* (LE 309174). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Mt. Lysaya, 45°00'14"N, 136°30'00"E, elev. 850 m, 2.ix.2013, on *C. mitis* (podetia), *M.P. Zhurbenko 13151c* (LE 308497c). **MONGOLIA. DZABKHAN AIMAK:** 10 km W of Toson-Tsengel, elev. 2050 m, 3.vii.1976, on *C. chlorophaea* s. lat. (moribund podetia), *L.G. Biazrov 6354a* (LE 308871a). **U.S.A. ALASKA:** Kotzebue, 66°53'N, 162°31'W, elev. 30 m, 19.viii.2000, on *C. sulphurina* (podetia), *M.P. Zhurbenko 00230* (LE 309096). **CANADA. BRITISH COLUMBIA:** Mount Revelstoke National Park, elev. 700 m, 18.vii.2002, on *C. pocillum* (basal squamules, podetia), *M.P. Zhurbenko 0243c* (LE 308737c). **FRANCE (OVERSEAS DEPARTMENT). RÉUNION:** NE of Bourg-Murat, Col de Bellevue, 21.17797°S, 55.58010°E, elev. 1617 m, 9.ix.2009, on *C. intermediella* (apothecia), *F. Schumm & J.-P. Frahm 15179* (H). **NEW ZEALAND. SOUTH ISLAND:** Pisa Conservation Area, 1 km SW of Cardrona, 44.992°S, 168.953°E, elev. 1040 m, 10.vi.2010, on *C. cervicornis* ssp. *mawsonii* (podetia), *F. Högnabba 1524* (H).

***Lichenopeltella cladoniarum* E.S. Hansen & Alstrup**

NOTES. – The specimens we examined differ from the protologue in having 4-spored versus 8-spored asci (Hansen & Alstrup 1995). In our material the ascomata were 50–90 µm in diameter, the asci were (31–)34–42(–50) × (11.5–)12–13(–15) µm (n = 30), and the ascospores were (12.3–)15.5–18.9(–22.8) × (4.4–)4.8–5.8(–6.5) µm, l/b = (2.4–)2.8–3.6(–4.3) (n = 92, in water or K). Our material was found on podetia of *Cladonia arbuscula*, *C. portentosa* ssp. *pacifica*, *C. rangiferina* and *C. stellaris*. Pathogenicity was not observed. *Cladonia portentosa* ssp. *pacifica* is a new host.

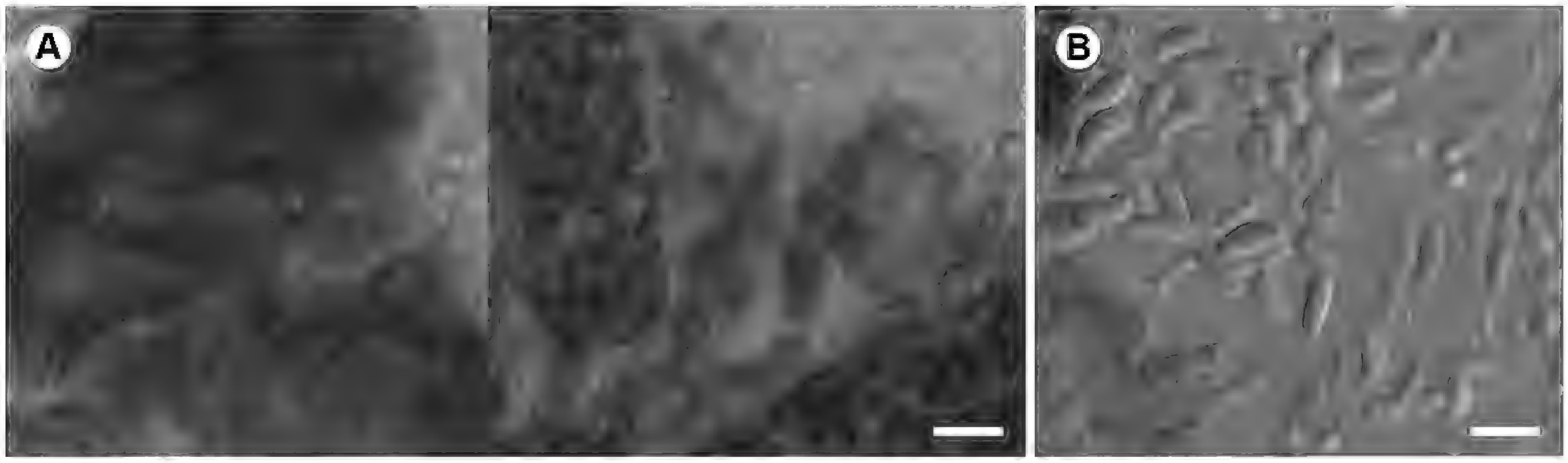

Figure 7. *Lichenosticta alcicorniaria*. **A,** outer excipular hyphae in water (left; LE 309439) and K (right; LE 308760). **B,** occasionally pigmented conidia in K (LE 308760). Scale bars = 10 µm.

Specimens examined. – **RUSSIA. MURMANSK REGION:** 4 km SSE of Dal'nie Zelentsy, 69°05'N, 36°07'E, elev. 100 m, 21.viii.1997, on *Cladonia rangiferina* (podetia), *M.P. Zhurbenko 97420* (LE 308926); Khibiny Mts., Mt. Kukisvumchorr, 67°42'N, 33°36'E, elev. 450 m, 9.viii.1997, on *C. arbuscula* (podetia), *M.P. Zhurbenko 9717b* (LE 308940b); Kaskasnyunjok Creek, 67°46'N, 33°49'W, 18.viii.2007, on *C. stellaris* (podetia), *M.P. Zhurbenko 0766b* (LE 210308b). **NENETS AUTONOMOUS AREA:** Bol'shezemel'skaya tundra, Cape Bolvanskii Nos, 68°14'N, 54°28'E, 25.vii.1999, on *C. arbuscula* (base of podetia), *O.V. Lavrinenko s.n.* (LE 264347). **CHUKOTKA AUTONOMOUS AREA:** Vel'ma River, 15.vi.1939, on *Cladonia* sp. (podetia), *A.A. Trushkovskii s.n.* (LE 308786). **U.S.A. ALASKA:** Aleutian Islands, Amlia Island, 52.05933°N, 173.40353°W, elev. 41 m, 17.viii.2010, on *C. portentosa* ssp. *pacifica* (podetia), *S. Talbot AML003-29a* (H); Carlisle Island, 52°54'N, 170°03'W, 28.vii.2013, on *C. arbuscula* (bleached parts of podetia), *S. Talbot & S. Talbot CAR001-23a* (H).

***Lichenopeltella uncialicola* Brackel**

NOTES. – The examined specimens differ from the protologue (Brackel 2010a) in having 8-spored rather than 4-spored asci. However, asci with four to eight ascospores have been reported for the species (Brackel 2013). In our material the ascomata were approximately 50 µm in diameter, with divergent setae around the ostiole, the asci were 25–26 × 12–14 µm (n = 3), and the ascospores were 1-septate, (11.8–)12.5–13.9(–14.2) × (3.5–)3.6–3.8(–4.0) µm, l/b = (3.2–)3.4–3.8(–3.9) (n = 11). Setulae were not observed on the ascospores. *Lichenopeltella uncialicola* was previously known only from Iceland where it was found on *Cladonia uncialis*, and from Italy where it was found on *C. rangiferina* (Brackel 2010a, 2013).

Specimen examined. – **DENMARK. GREENLAND:** Frederikshåbs Isblink, 62°37'N, 50°08'W, dwarf shurb heath, 7.vii.2009, on *Cladonia rangiferina* (podetia), *E.S. Hansen s.n.* = *Lichenes Groenlandici Exsiccati #1092* (H).

***Lichenopeltella* sp.**

NOTES. – The material cited below possibly represents an unusual specimen of *Lichenopeltella cladoniarum* with comparatively large ascomata and small ascospores (see notes on this species above). Additional material is needed to verify the characteristics, particularly the presence of ascospore setulae, which are absent in *Lichenopeltella cladoniarum*. Our material is characterized by having ascomata 87–107 µm in diameter, without ostiolar setae, 4(–8)-spored asci 33–42 × 11.5–14 µm (n = 5) in size, and ascospores (11.9–)13.5–16.7(–18.0) × (3.6–)3.8–4.2(–4.5) µm in size [l/b = (3.1–)3.4–4.2(–4.6); n = 26, in K], 1-septate, often pseudotetrablastic (seen in K), possibly rarely with 3 pairs of setulae, although the latter were not distinctly observed.

Specimen examined. – **RUSSIA. PRIMORYE TERRITORY:** Sikhote-Alin' Range, Mt. Glukhomanka, 45°10'N, 135°48'E, elev. 1500 m, 21.viii.2003, on *Cladonia* sp. (moribund bases of podetia), *K.S. Podlubnaya s.n.* (LE 308694a).

Lichenosticta alcicorniaria **(Linds.) D. Hawksw.**

FIGURE 7

NOTES. – As was already noted by Hawksworth (1981) the exciple in this species is composed of multiple layers, inwardly paraplectenchymatous, outwardly composed of somewhat darker, branched, septate, intertwined hyphae (Figure 7A). The conidia in our material were hyaline or exceptionally brownish (Figure 7B), more or less reniform or sometimes ellipsoid or oblong, sometimes slightly wider below, the apex rounded, the base somewhat attenuated and acute (usually giving a lacriform appearance) or occasionally rounded, and (5.1–)7.0–9.2(–12.2) × (2.2–)3.2–4.0(–5.0) µm in size [l/b = (1.6–)1.9–2.7(–3.9); n = 276]. The species was found on *Cladonia arbuscula*, *C. cervicornis*, *C. chlorophaea* s. lat., *C. coniocraea*, *C. cornuta*, *C. cyathomorpha*, *C. deformis*, *C. fimbriata*, *C. furcata*, *C. gracilis* s. lat., *C. gracilis* ssp. *turbinata*, *C. macroceras*, *C. mitis*, *C. multiformis*, *C. ochrochlora*, *C. pleurota*, *C. pocillum*, *C. pyxidata*, *C. rangiferina*, *C. stricta* s. lat., *C. sulphurina*, *C. symphycarpa*, *C. tessellata* and unidentified *Cladonia* species. It occurs mainly on the undersides of basal and podetial squamules or occasionally directly on podetia. Pathogenicity not observed. Widely distributed in the Holarctic including the tundra biome, the species is particularly common in forested habitats. Here we report it new to Japan. *Cladonia cervicornis*, *C. cyathomorpha*, *C. deformis*, *C. multiformis*, *C. pleurota*, *C. rangiferina*, *C. stricta* s. lat., *C. sulphurina* and *C. tessellata* are new host species.

Specimens examined. – **PORTUGAL. MADEIRA:** João do Prado, 32º43.11'N, 16º51.72'W, elev. 1240 m, 27.iv.2012, on *Cladonia cyathomorpha* (underside of basal squamules), *P.P.G. Van den Boom 47591a* (H). **NORWAY. TROMS CO.:** Skibotndalen valley, 69º19.6'N, 20º21.2'E, elev. 50 m, 6.viii.2003, on *Cladonia* sp. (underside of basal squamules), *M.P. Zhurbenko 037* (LE 309101). **FINLAND.** Päijänne Tavastia, Sysmä, Hovila, 10.iv.2010, on *C. mitis*, *V. Haikonen 27511a* (H); Uusimaa, Sipoo, 60.27ºN, 25.15ºE, 13.ix.2014, on *C. arbuscula* (podetia), *R. Pino-Bodas s.n.* (H). **RUSSIA. REPUBLIC OF ADYGEYA:** Caucasus, Mt. Tybga, 43°52'48" N, 40°15'59" E, elev. 2480 m, 5.viii.2014, on *C. mitis* (podetia), *M.P. Zhurbenko 14442* (LE 309439); Lagonaki Upland, Azishskii pass, 44°04'33"N, 40°00'58"E, 16.viii.2014, elev. 1750 m, on *C. coniocraea* (underside of basal squamules, rarely podetia), *M.P. Zhurbenko 14283* (LE 308615), on *C. pocillum* (basal squamules), *A.A. Kobzeva 1485a* (LE 308620a). **KRASNODAR TERRITORY:** Caucasus, Lagonaki Upland, Mt. Fisht, 43°58'N, 39°56'E, elev. 1600 m, 18.viii.2014, on *C. pocillum* (underside of basal squamules), *M.P. Zhurbenko 14287* (LE 308619), 19.viii.2014, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 14413* (LE 309441), on *Cladonia* sp. (underside of basal squamules), *M.P. Zhurbenko 14417* (LE 309440), 23.viii.2014, on *C. pyxidata* (basal squamules, mainly their undersides), *M.P. Zhurbenko 14298b* (LE 309190b), *M.P. Zhurbenko 14285* (LE 308617); Mt. Armovka, 43°52'28"N, 40°39'20"E, elev. 2250 m, 30.viii.2014, on *C. chlorophaea* s. lat. (podetia and basal squamules, mainly their underside), *M.P. Zhurbenko 14284* (LE 308616), 31.viii.2014, on *C. pyxidata* (basal squamules, mainly their underside), *M.P. Zhurbenko 14286* (LE 308618), *M.P. Zhurbenko 14294* (LE 309172). **NENETS AUTONOMOUS AREA:** Bol'shezemel'skaya tundra, Ortin River, 67°50'04"N, 54°04'35"E, 28.vi.1999, on *C. sulphurina* (basal squamules, podetia), *O.V. Lavrinenko s.n.* (LE 308927); on *C. coccifera* (underside of basal squamules, occasionally podetia), *O.V. Lavrinenko s.n.* (LE 308896); Khar'yaga oilfield, 67°11'N, 56°30'E, elev. 60 m, 24.vii.2007, on *C. sulphurina* (podetia), *M.P. Zhurbenko 0775* (LE 308568). **KRASNOYARSK TERRITORY:** Western Sayan Mts., Ergaki Nature Park, Nizhnyaya Buiba River, 52°46'N, 93°22'E, elev. 1150 m, 26.vii.2010, on *C. pyxidata* (basal squamules, occasionally podetia), *M.P. Zhurbenko 1043* (LE 308680); Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 8.vii.2009, on *C. pocillum* (basal squamules, occasionally podetia), *M.P. Zhurbenko 0961a* (LE 308662a). **REPUBLIC OF BURYATIA:** Tunka Mts., Arshan, 51º56'N, 102º25'E, elev. 850 m, 11.vi.2005, on *C. pocillum* (upper side of basal squamules), *M.P. Zhurbenko 0524* (LE 309102); Kitoi Mts., 3 km N of Oka Lake, 51°55'N, 100º40'E, elev. 2000 m, 15.vi.2005, on *C. cornuta* (underside of basal and podetial squamules, occasionally podetia), *M.P. Zhurbenko 05196* (LE 309104), on *C. pyxidata* (lower and sometimes upper sides of basal squamules, occasionally podetia), *M.P. Zhurbenko 05194* (LE 309103); Dzherginskii Reserve, Dzhirga River valley, 54°54'14"N, 111°16'27"E, 19.vii.2002, on neighbouring *C. gracilis* and *C. ochrochlora* (underside of basal squamules, occasionally podetia), *T.M. Kharpukhaeva s.n.* (LE 309105a). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Mt. Glukhomanka, 45°10'N, 135°48'E, elev. 1500 m, 22.viii.2003, on *C. furcata* (podetia), *K.S. Podlubnaya s.n.* (LE 308699). **SAKHALIN REGION:** Sakhalin Island, Tym' River, 50°51'N, 142°40'E, 16.ix.2007, on *C. coniocraea* (underside of basal squamules), *I.F. Skirina s.n.* (LE 308648); Mt. Bol'shevik near Yuzhno-Sakhalinsk,

46°57'N, 142°47'E, elev. 570 m, 13.x.1996, on *C. gracilis* s. lat. (podetial squamules), *A.A. Dobrysh s.n.* (LE 308816); Kunashir Island, 19.ix.1996, on *C. ochrochlora* (underside of basal and podetial squamules), *A.A. Dobrysh s.n.* (LE 308772), 20.ix.1996, *A.A. Dobrysh s.n.* (LE 308837); Iturup Island, Baranovskogo volcano, 43°39'N, 131°55'E, 6.x.1996, on neighbouring *C. cornuta* and *C. stricta* s. lat. (basal squamules, podetia), *A.A. Dobrysh s.n.* (LE 308834). **CHUKOTKA AUTONOMOUS AREA:** conjunction of Enmyvaam and Shumnaya Rivers, 68°15'N, 166°03'E, 1.vii.1980, on *C. coccifera* (basal squamules), *I.I. Makarova s.n.* (LE 308811); Bezymyannoe Lake, 66°39'N, 176°40'E, 5.vii.1979, on *C. coccifera* (basal squamules), *I.I. Makarova s.n.* (LE 308783b). **MONGOLIA. ARA-KHANGAI AIMAK:** Khukh-Sumein-Gol River, 47°15'N, 101°50'E, 22.vii.1970, on *C. chlorophaea* s. lat. (basal squamules), *L.G. Biazrov 1690b* (LE 308840b), 17.viii.1979, on *C. pleurota* (basal squamules), *L.G. Biazrov 5952* (LE 308867), 13.vii.1973, on *C. cornuta* (podetia), *L.G. Biazrov 2031* (LE 308856); Mt. Bayaskhalan-Ula, 48°02'N, 99°25'E, elev. 2700 m, 17.vi.1973, on *C. macroceras* (podetia), *L.G. Biazrov 2084* (LE 308864). **JAPAN. HOKKAIDO:** Mt. Dairoku, elev. 1300 m, 1.ix.1972, on *C. rangiferina* (podetia), *T. Ahti 28164b* (H). **U.S.A. ALASKA:** Kenai Peninsula, Chugach National Forest, 60°10'N, 149°30'W, elev. 150 m, 1.ix.2000, on *C. cornuta* (underside of basal squamules), *M.P. Zhurbenko 00478b* (LE 309142b); Tongass National Forest, Gravina Island, 55°10'N, 131°46'W, elev. 300 m, 17.viii.2000, on *C. chlorophaea* s. lat. (underside of basal squamules), *K. Dillman s.n.* (LE 308510); Aleutian Islands, Adak Island, Mt. Reed, 51.83191°N, 176.67477°W, elev. 130 m, moss meadow, 28.viii.2013, on *C. rangiferina* (throughout the length of podetia to their tips), *S. Talbot & S. Talbot s.n.* (H); Prince of Wales Island, Salt Chuck mine, 55°37'28"N, 132°33'04"W, elev. 5 m, 7.viii.2001, on *C. ochrochlora* (underside of basal squamules) on driftwood, *M.P. Zhurbenko 01206* (LE 309100); between Flicker and Baker Creeks, 56°20'56.3"N, 133°33'56.5"W, elev. 5 m, 11.viii.2001, on *C. ochrochlora* (underside of basal squamules, occasionally podetia), *M.P. Zhurbenko 0113* (LE 309099). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Battle Creek, elev. 750 m, 5.viii.2002, on *C. coniocraea* (basal squamules, occasionally podetia), *M.P. Zhurbenko 02366* (LE 308733); Spahats Creek, 51°44'23"N, 120°00'23"W, elev. 770 m, 10.vii.2002, on *C. cornuta* (basal squamules, podetia), *M.P. Zhurbenko 02280b* (LE 308806b), on *C. fimbriata* (basal squamules, occasionally podetia), *M.P. Zhurbenko 02242b* (LE 308722b); Philip Creek, 52°52'N, 120°00'W, elev. 800 m, 30.vii.2002, on *C. chlorophaea* s. lat. (basal squamules, podetia), *M.P. Zhurbenko 02154b* (LE 308740b), on *C. pyxidata* (basal squamules), *M.P. Zhurbenko 02155c* (LE 308704c), on *Cladonia* sp. (basal squamules, podetia), *M.P. Zhurbenko 02276* (LE 308725), on *C. symphycarpa* (basal squamules, occasionally podetia), *M.P. Zhurbenko 02277* (LE 308724), on *C. multiformis* (basal squamules, podetia), *M.P. Zhurbenko 02166* (LE 308720), on *C. cervicornis* (basal squamules, podetia), *M.P. Zhurbenko 02158* (LE 308717); Murtle River, 51°57'51"N, 120°07'24"W, elev. 730 m, 9.vii.2002, on *C. ochrochlora* (basal squamules, rarely podetia), *M.P. Zhurbenko 02250* (LE 308721), 10.vii.2002, on *C. gracilis* ssp. *turbinata* (podetia), *M.P. Zhurbenko 02193* (LE 308719); Clearwater River, 51°43'16"N, 120°01'25"W, elev. 550 m, 14.vii.2002, on *C. deformis* (basal squamules, podetia), *J. Miadlikowska s.n.* (LE 308759b); Mount Revelstoke National Park, elev. 700 m, 18.vii.2002, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 0243b* (LE 308737b), on *C. pyxidata* (basal squamules, occasionally podetia), *M.P. Zhurbenko 02400* (LE 308702), on *C. ochrochlora* (basal and podetial squamules, occasionally podetia), *M.P. Zhurbenko 0246* (LE 308739); Columbia Mts., Beaver River, 51°18'N, 117°24'W, elev. 1100 m, 16.vii.2002, on *C. sulphurina* (basal squamules), *M.P. Zhurbenko 0298b* (LE 308748b), 17.vii.2002, on *C. ochrochlora* (basal squamules, occasionally podetia), *M.P. Zhurbenko 022* (LE 308718); Columbia River Valley near mouth of Downie Creek, elev. 650 m, 20.vii.2002, on *C.* cf. *ochrochlora* (basal squamules, occasionally podetia), *M.P. Zhurbenko 0225b* (LE 308778b); Columbia River Valley near mouth of Mica Creek, 23.vii.2002, on *C. coniocraea* (basal squamules), *M.P. Zhurbenko 02360* (LE 308747), on *C. ochrochlora* (basal squamules, podetia), *M.P. Zhurbenko 0266* (LE 308780), on *C. fimbriata* (basal squamules), *M.P. Zhurbenko 02405* (LE 308745), on *C. sulphurina* (basal squamules, occasionally podetia), *M.P. Zhurbenko 0285* (LE 308760), on *C. symphycarpa* (basal squamules), *M.P. Zhurbenko 0223* (LE 308761). **NEWFOUNDLAND AND LABRADOR:** Newfoundland, Terra Nova National Park, Newman Sound, 48°33'N, 53°53'W, elev. 5 m, 10.ix.2011, on *C. coniocraea* (squamules) *T. Ahti 71229* (H). **ARGENTINA. SANTA CRUZ PROVINCE:** Huemul Glacier, 49°04'S, 72°54'W, i.2007, on *C. cornuta* (basal squamules), *I. Garibotti 115* (H). **CHILE. REGIÓN DE LOS LAGOS:** Alerce Andino National Park, Guarderia, 41°27'47"W, 72°38'41"W, elev. 130 m, 14.ii.2013, on *C. tessellata* (underside of squamules), *U. Schiefelbein 3940a* (H).

***Lichenostigma alpinum* (R. Sant., Alstrup & D. Hawksw.) Ertz & Diederich s. lat. (anamorph)**

NOTES. – This is probably a cosmopolitan species, which is very common at least in the Arctic. It was described from *Ochrolechia frigida* (Alstrup & Hawksworth 1990) and subsequently reported from various lichen genera including *Cladonia* (Brackel 2014). However, it is possible that the reports from disparate hosts belong to morphologically similar, but different species (Ertz et al. 2014). We found the species on podetia and/or occasionally basal squamules of *Cladonia arbuscula*, *C. nipponica*, *C. pocillum*, *C. rangiferina*, *C. stricta*, *C. subcervicornis* and *C. symphycarpa*. Heavy infections caused bleaching of the host tissues. Here we report the species for the first time from Mongolia. *Cladonia arbuscula*, *C. nipponica*, *C. rangiferina*, *C. stricta*, *C. subcervicornis* and *C. symphycarpa* are new host species.

Specimens examined. – **NORWAY. SVALBARD:** Murchison fjord, Nord Bay, 80°02'11"N, 18°49'04"E, elev. 45 m, 14.viii.2007, on neighbouring *Ochrolechia frigida* and *Cladonia symphycarpa* (basal squamules), *N.V. Matveeva s.n.* (LE 308560). **RUSSIA. ARKHANGELSK REGION:** Franz Josef Land, Scott Keltie Island, 80°20'N, 52°18'E, 25.vii.1930, on *C. stricta* (podetia), *V.P. Savicz s.n.* (LE 308793). **KRASNOYARSK TERRITORY:** Severnaya Zemlya Archipelago, Bol'shevik Island, Cape Antsev, 78°13'N, 103°15'E, 16.vii.2000, on *C. subcervicornis* (podetia), *N.V. Matveeva s.n.* (LE 308546). **REPUBLIC OF BURYATIA:** Eastern Sayan, Tunka Mts., near Arshan, Kyngarga River valley, 51°56' N, 102°25' E, elev. 1080 m, 11.vi. 2005, on *C. pocillum* (basal squamules, podetia), *M.P. Zhurbenko 05303* (LE 309618). **REPUBLIC OF SAKHA (YAKUTIA):** 3 km SW of Tiksi, 71°40'N, 128°40'E, elev. 50 m, 17.vii.1998, on *C. arbuscula* (podetia), *M.P. Zhurbenko 98415* (LE 308919). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Mt. Lysaya, 45°00'14"N, 136°30'00"E, elev. 850 m, 2.ix.2013, on *C. nipponica* (podetia, mainly on their apices), *M.P. Zhurbenko 13141* (LE 308488). **CHUKOTKA AUTONOMOUS AREA:** upper Televeem River, 65°50'N, 175°05'E, 22.vii.1979, on *C. nipponica* (podetia), *I.I. Makarova s.n.* (LE 308821); km 174 of road from Egvekinot to Iul'tin, 67°41'N, 178°35'W, 28.vii.1980, on *C. pocillum* (basal squamules), *B.A. Yurtsev s.n.* (LE 308818). **MONGOLIA. UBSUNUR AIMAK:** Mt. Tsagan-Khairkhan-Ula, 49°23'N, 94°20'E, elev. 2100 m, 6.vii.1976, on *C. rangiferia* (podetia), *L.G. Biazrov 6556* (LE 308846). **U.S.A. ALASKA:** near Fairbanks, Morphy Dome, 64°57'N, 148°21'W, elev. 700 m, 27.viii.2000, on *C. rangiferina* (podetia), *M.P. Zhurbenko 0013* (LE 309164).

***Lichenostigma maureri* Hafellner (anamorph)**

NOTES. – This is probably a cosmopolitan species, common at least in forested environments of the Holarctic. It was described from *Usnea florida* (Hafellner 1982) and subsequently reported from various genera of macrolichens including *Cladonia* (Brackel 2014, Ertz et al. 2014). We found it on basal squamules and/or podetia of *Cladonia subulata* and *C. rangiferina*, both of which are new host species.

Specimens examined. – **RUSSIA. REPUBLIC OF SAKHA (YAKUTIA):** Indigirka River, Moma rapids, 65°25'N, 142°43'E, elev. 400 m, 18.vii.1992, on *C. subulata* (podetia), *M.P. Zhurbenko 92565* (LE 308882); 8 km SW of Ust'-Nera, 64°31'N, 143°08'E, elev. 700 m, 23.vii.1992, on *C. rangiferina* (podetia), *M.P. Zhurbenko 92569* (LE 308938). **MONGOLIA. ARA-KHANGAI AIMAK:** watershed of Khukh-Sumein-Gol and Tsetserleg-Gol Rivers, Mt. Khairkhan, 47°15'N, 101°50'E, elev. 2100 m, 1.viii.1979, on *C. ochrochlora* (basal squamules, podetia), *L.G. Biazrov 3385a* (LE 308869a).

***Merismatium coccisporum* (Norman) Vouaux**

NOTES. – According to Triebel (1989) the ascospores of this species are rather variable in size [(8.5–)11–17(–19) × (5–)6.5–8(–9.5) µm], shape and septation, mainly with obtuse apices. The species mostly occurs on saxicolous lichens; however, it has also been reported on an unidentified lichen on soil (Spribille et al. 2010). In our material the ascomata were 110–180 µm in diameter, semi-immersed to sessile, the ascospores were medium orange brown (walls and septa often much darker than lumen), ellipsoid to occasionally broadly or narrowly ellipsoid, apices acute or occasionally obtuse, with 2–6 transsepta or oblique septa and 0–3 longisepta in central segments, and (10.4–)12.7–16.9(–20.9) × (6.0–)6.9–8.7(–11.9) µm in size [l/b = (1.3–)1.6–2.2(–2.9); n = 54]. *Cladonia* is a new host genus.

Specimen examined. – **RUSSIA. KRASNOYARSK TERRITORY:** Putorana Plateau, Kapchuk Lake, 69°29'N, 91°00'E, elev. 1000 m, 13.viii.1983, on *Cladonia pyxidata* (bleached portions of basal squamules), *M.P. Zhurbenko 83161b* (LE 207221b).

***Merismatium decolorans* (Arnold) Triebel**

DESCRIPTION. –*Ascomata* subglobose, brownish black, glossy, (75–)125–250 µm in diameter, more or less sessile. *Ascospores* ellipsoid, narrowly ellipsoid or clavate (narrower below), rarely of irregular shape, for example triangular, initially subhyaline, then light brown (sometimes with a gray tinge) and finally medium brown, walls and septa usually much darker than lumen, end cells sometimes paler, with (0–)1–3(–4) transsepta and rarely 1(–2) longitudinal or oblique septa in central segments, sometimes slightly constricted at the septa, (9.3–)11.4–14.4(–16.7) × (3.6–)4.1–5.5(–7.0) µm, l/b = (1.4–)2.3–3.1(–3.5) (n = 108), smooth-walled, non-halonate.

NOTES. – The examined material fits well the description in Triebel (1989), except for the ascospores, which were reported to be slightly longer [(10.5–)13.5–16.5(–17.5) × (3.5–)4–5.5(–6) µm]. We found this species on the basal squamules of *Cladonia pocillum*, *C. pyxidata*, *C. ramulosa*, unidentified *Cladonia* species and usually on neighbouring algal films, lichens, bryophytes and detritus on soil. Pathogenicity was not observed in our material. *Cladonia pocillum* and *C. ramulosa* are new host species.

Merismatium cladoniicola Alstrup is an obscure species so far known from the holotype collected in Norway where it was fround on a moribund thallus of *Cladonia ciliata* (as *C.* '*ciliaris*'; Alstrup 1997), and from a specimen from the Russian Caucasus growing on the basal squamules of *C. pocillum* (reported as *Merismatium* cf. *cladoniicola*; Zhurbenko & Kobzeva 2014). In the protologue the end cells of the ascospores of *M. cladoniicola* have been described as being often hyaline (Alstrup 1997). This character has not been reported before for *M. decolorans*, but paler ascospore end cells were occasionally observed in the examined material. Given this observation, *M. cladoniicola* fits within the range of variability of *M. decolorans* and most likely is a heterotypic synonym of the latter. However we refrain from a formal synonymy pending further more detailed study.

Specimens examined. – **SPAIN. MALAGA:** Los Reales de Sierra Bermeja, 36°29.458'N, 5°12.158'W, elev. 1154 m, 23.xii.2012, on *Cladonia ramulosa* (basal squamules) and possibly on adjacent thallus of unidentified lichen, *O. Miettinen 15975a* (H). **RUSSIA. KRASNOYARSK TERRITORY:** Putorana Plateau, Lama Lake near Deme River mouth, 69°30'N, 90°42'E, elev. 60 m, 6.viii.1983, on *Cladonia* sp. (basal squamules) and adjacent films of lichens and algae on soil, *M.P. Zhurbenko* 83237 (LE 308902); Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°28'E, elev. 1450 m, 8.vii.2009, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 0951* (LE 309165), 24.vii.2009, on mosses, algal films and occasionally on basal squamules of *C. pocillum*, *M.P. Zhurbenko 0974b* (LE 308674b). **REPUBLIC OF SAKHA (YAKUTIA):** lower Lena River, Daldyn River, ca. 68°30'N, 124°00'E, 13.viii.1957, on *C. pyxidata* (basal squamules) and adjacent plant remnants, *A.N. Lukicheva s.n.* (LE 308513b).

***Merismatium* cf. *nigritellum* (Nyl.) Vouaux**

NOTES. – In the specimens cited below the ascomata were 100–150 µm in diameter, slightly erumpent to semi-immersed, and associated with conspicuous septate brown vegetative hyphae. The ascospores had 3–8 tanssepta and 1(–2) longitudinal or oblique septa in most segments, and measured (16.5–)19.9–24.5(–28.5) × (5.7–)7.4–9.4(–10.7) µm in size [l/b = (2.1–)2.4–3.0(–3.3); n = 69]. Goniocysts were only sometimes present. Triebel (1989) reported ascomata of the species to be mainly superficial and larger than those we observed [(150–)200–250(–300) µm in diameter], and the ascospores were also reported to be wider [(14–)15–24.5(–32) × (6.5–)8–12(–15) µm]. The species has previously been reported on *Cladonia* by Brackel (2014). We found the species growing on the bleached basal squamules of *Cladonia pocillum*, *C. pyxidata* and an unidentified *Cladonia* species.

Specimens examined. – **NORWAY. TROMS CO.:** Skibotndalen Valley, 69°19.4'N, 20°21.4'E, elev. 70 m, 6.viii.2003, on *Cladonia pocillum* (bleached basal squamules), *M.P. Zhurbenko 03456* (LE 309168). **RUSSIA. KRASNOYARSK TERRITORY:** Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°28'E, elev. 1500 m, 15.vii.2015, on *Cladonia* sp. (bleached basal squamules), *M.P. Zhurbenko 0965* (LE 308666); on *C. pyxidata* (bleached basal squamules), 14.vii.2009, *M.P. Zhurbenko 0970* (LE 308671). **REPUBLIC OF SAKHA (YAKUTIA):** Tiksi, 71°37'N, 128°54'E, elev. 70 m, 18.vii.1998, on *Cladonia* sp. (moribund basal squamules), *M.P. Zhurbenko 98416a* (LE 308912a).

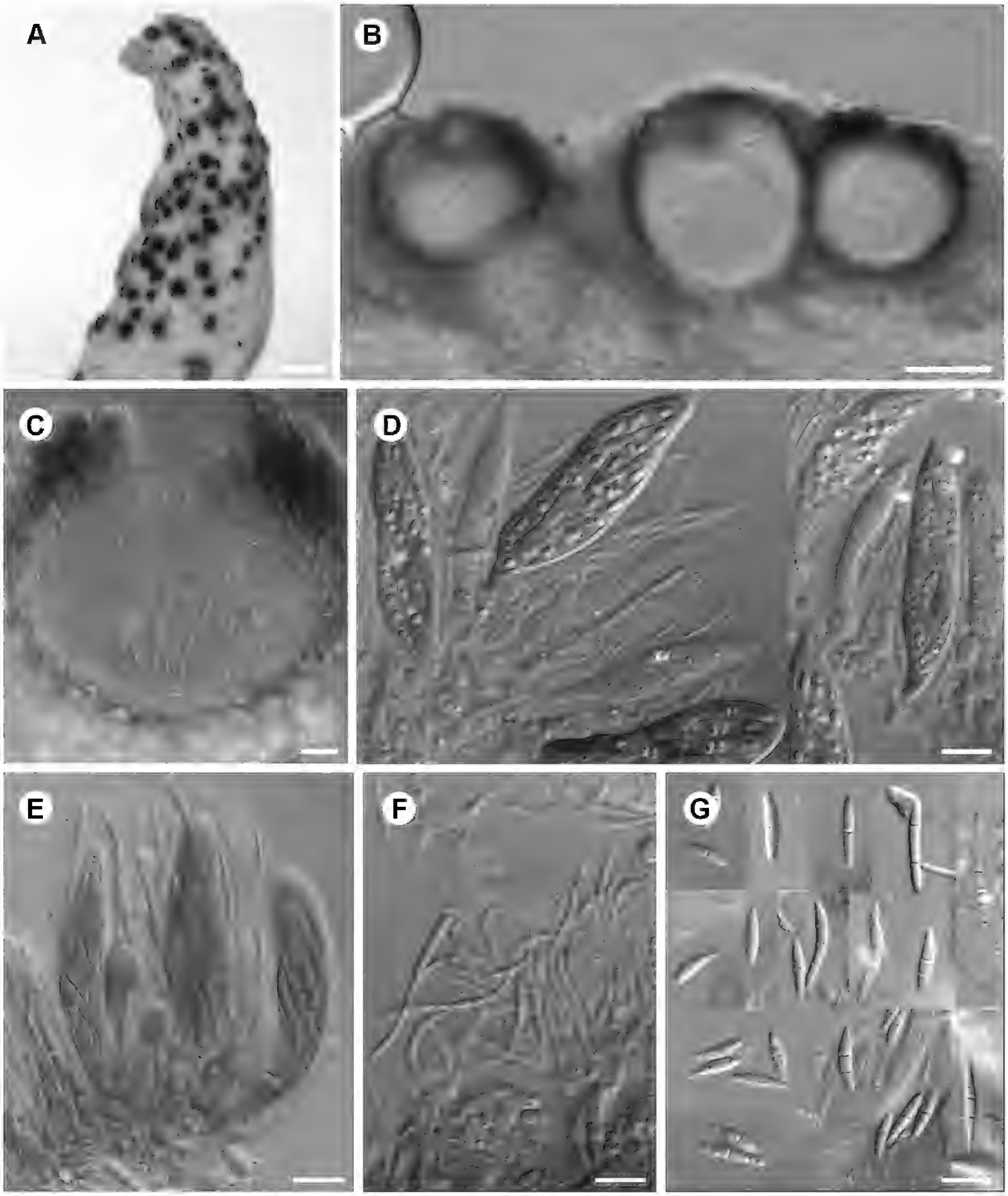

Figure 8. *Neolamya ahtii* (A-D and F from the holotype, E from LE 308800, G from LE 308587). **A,** ascomata. **B & C,** ascomata in cross section in water. **D,** asci in K/I. **E,** asci in I. **F,** paraphyses in K. **G,** ascospores in water. Scale bars: A = 200 µm, B = 50 µm, C–G = 10 µm.

Neoburgoa freyi **Diederich, Zimmermann & Lawrey**

NOTES. – This recently described species has previously been reported from several alpine localities in the Alps (Switzerland) where it grew on thalli of *Cladonia rangiferina* (Lawrey et al. 2016). Here we report it as new to Russia and report *Cladonia stellaris* as a new host species.

Specimen examined. – **RUSSIA. MURMANSK REGION:** Khibiny Mts., Mt. Kukisvumchorr, 67°42'N, 33°36'E, elev. 450 m, 9.viii.1997, on *Cladonia stellaris* (podetia), *M.P. Zhurbenko 9714* (LE 309619).

Neolamya ahtii **Zhurb., sp. nov.**

MycoBank #MB 819557

FIGURE 8

DIAGNOSIS. – Lichenicolous fungus. Morphologically similar to *Neolamya peltigerae*, but distinguished primarily by the smaller ascomata, the (8–)16-spored (vs. 16–32-spored) asci, the (0–)1(–3)-septate, 14–22 µm long (vs. 3–6-septate, 65–81 µm long) ascospores, and different host (*Cladonia* vs. *Peltigera*).

TYPE: **RUSSIA. NENETS AUTONOMOUS AREA:** SE of Bol'shezemel'skaya tundra, vicinities of Khar'yaga oilfield, 67º11'N, 56º30'E, elev. 60 m, dwarf shrub-moss-lichen tundra, 24.vii.2007, on *Cladonia gracilis* (podetia) accompanied by *Epicladonia sandstedei* and *Heterocephalacria bachmannii*, *M.P. Zhurbenko 0739a* (LE 308554!, holotype).

DESCRIPTION. – *Ascomata* perithecia, black (dark brown when wet), matt, subglobose, 60–150 µm in diameter, without clypeus, with a rather irregular pore 15–30 µm lengthways, immersed to slightly protruding in the ostiolar region, without star-like radial splits of the host thallus, aggregated, often adjacent to confluent; wall medium brown and 10–20 µm thick above, hyaline to light brown and 5–10 µm thick below, slightly discoloring in K, innermost layer hyaline, composed of tangentially elongated cells; in surface view of *textura angularis* or *textura epidermoidea*. Ostiolar canal poorly developed. External periphyses (sensu Roux & Triebel 1994), internal periphyses and periphysoids not observed. *Hymenium* hyaline, 50–100 µm tall, hymenial gel I and K/I–. *Subhymenium* indistinct. *Paraphyses* abundant, lining the ascomatal cavity, reaching the ostiole, longer than asci, 20–60 µm long, 2–4 µm in diameter at the base, gradually attenuating towards non-swollen apex 1–1.5 µm in diameter, 1–4-septate, occasionally with small branchlets, sometimes with small guttules, embedded in gel matrix. *Asci* non-fissitunicate, more or less ellipsoid with rather acute and sometimes attenuated apex and short foot, wall thin, thickened at apex only when young, without a discernible ocular chamber, dehiscence not observed, (43–)47–61(–75) × 10–14(–17) µm (n = 23, in water, I or K/I), I and K/I–, (8–)16-spored. *Ascospores* hyaline, greatly varying in shape and size, fusiform to narrowly ellipsoid, occasionally bacilliform or ellipsoid, rarely with slightly wider upper cell, apices rounded to occasionally acute or attenuated, (6.7–)13.5–22.1(–34.0) × (2.3–)2.7–3.9(–6.0) µm, l/b = (1.8–)3.8–7.4(–11.0) (n = 142, in water, I or K/I), (0–)1(–3)-septate, not or rarely slightly constricted at median septum (seen in K), smooth-walled, non-halonate, with large guttules, irregularly 2–6-seriate in the asci. *Anamorph* not found.

ETYMOLOGY. – Named in honor of Teuvo Ahti for his outstanding contribution to lichenology and particularly to the knowledge of the lichen genus *Cladonia*.

DISTRIBUTION AND HOSTS. – The new species is known from three specimens collected in the tundra biome of Europe, Asia and North America, growing on podetia of *Cladonia gracilis* and *C. stellaris*. It causes strong bleaching of the infected host parts.

DISCUSSION. – The placement of the new species in *Neolamya* Theiss. & Syd. is tentative, as the generic type *N. peltigerae* (Mont.) Theiss. & Syd. differs in several essential features, i.e., ascomata covered by thin clypeus, presence of external and internal periphyses and periphysoids, unbranched paraphyses and 16–32-spored asci (Ertz 2004, Kocourková 2009). *Neolamya peltigerae* occurs on species of *Peltigera* and further differs from *N. ahtii* in inducing star-like radial splits of the host thallus, in having

larger ascomata up to ca. 300 µm in diameter, unbranched paraphyses, larger asci [(77.5–)93.5–119.5(–120.0) × (16.0–)18.0–24.0(–27.0) µm] and filiform to long fusiform, 3–6 septate, longer ascospores [(56.0–)65.0–81.0(–90.0) × (2.0–)2.5–3.0(–3.5) µm, l/b = (18.3–)22.5–31.9(–36)] (Kocourková 2009). It is noteworthy that although the species has been characterized as commensalistic (Ertz 2004, Kocourková 2009) heavy infections cause slight bleaching of the host tissues (Zhurbenko 2009b).

Neolamya xanthoparmeliae Kocourk. is the only other member of the genus described to date, and it grows on species of *Xanthoparmelia*. It differs from *N. ahtii* in its larger ascomata (up to ca. 300 µm in diameter), consistently 16-spored and larger asci [(67.5–)98.0–137.5(–140.0) × (13.0–)15.0–20.5(–23.0) µm] and in the filiform to long fusiform, 3–10-septate, longer ascospores [(55.0–)60.0–90.0(–111.5) × (3.0–)3.5–4.75(–5.0) µm, l/b = (12.2–)18.8–21.4(–24.3)] (Kocourková 2009). The report of *N. peltigerae* on species of *Polychidium* (Aptroot et al. 1997) is based on scant material and probably refers to an undescribed species of *Neolamya* (Kocourková 2009; P. Diederich, pers. comm., 2016). Our material is also reminiscent of species of *Sagediopsis* (Sacc.) Vain. subgen. *Sagediopsis*, particularly *S. aquatica* (Stein) Triebel, *S. barbara* (Th. Fr.) R. Sant. & Triebel and *S. vasilyevae* Zhurb. (Hafellner 1993, Zhurbenko & Yakovchenko 2014). However, these species readily differ in having an amyloid or hemiamyloid hymenial gel and 8-spored asci.

Additional specimens examined. – **RUSSIA. CHUKOTKA AUTONOMOUS AREA:** Yuzhno-Anyuiskii Range, headwaters of Ottaipytgin River, stony tundra, 2.viii.1952, on *Cladonia stellaris* (podetia), *D. Baikova s.n.* (LE 308800). **U.S.A. ALASKA:** Seward Peninsula, 7 km ESE of Nome, 64°28'44"N, 165°16'03"W, elev. 5 m, shrub-dwarf shrub-lichen-moss tundra, 1.ix.2001, on *C. gracilis* ssp. *vulnerata* (podetia, often on their tips) accompanied by *Polycoccum microcarpum*, *M.P. Zhurbenko 0199a* (LE 308587).

***Niesslia cladoniicola* D. Hawksw. & W. Gams**

DESCRIPTION. – *Ascomata* perithecioid, black, glossy, subglobose, sometimes with small papilla, often with concave upper part when overmature, (50–)100–130(–150) µm in diameter (n = 73), ostiolate, setose throughout, superficial, dispersed to occasionally adjacent. *Setae* light to mainly medium or dark reddish brown, darker than the ascomatal wall, subulate, straight or sometimes flexuous, with sharp and occasionally attenuated apex, (11–)25–43(–58) µm long (n = 165), ca. 2 µm in diameter in the middle, abruptly expanded up to 10 µm across at the base, not branched or exceptionally with small outgrowths, wall 0.5–1 µm thick, aseptate. *Exciple* medium to dark reddish brown, pigmentation heterogeneous, K+ olive brown, in surface view of *textura epidermoidea*. *Periphyses* hyaline, acuminate, 8–18 × 1–2(–3.5) µm, occasionally septate. *Paraphyses* hyaline, filiform, apically not enlarged, 1–1.2 µm in diameter, branched, often indistinct. *Hymenial gel* I and K/I–. *Asci* subcylindrical, slightly swollen in the middle, with more or less truncate apex, not distinctly stalked, tholus 1–2.5 µm tall, with tiny marginal and central indentations, (35–)39–46(–47) × (4.5–)5–6(–7.5) µm (n = 21), I and K/I–, 8-spored. *Ascospores* hyaline, fusiform to occasionally oblong or clavate (slightly wider above), sometimes slightly curved, apices rounded, (6.5–)8.3–10.3(–13.1) × (1.6–)2.2–2.6(–3.0) µm, l/b = (2.6–)3.5–4.5(–5.5) (n = 141), 1-septate, not or rarely slightly constricted at the septum, smooth, usually with (1–)2(–3) large guttules in each cell, non-halonate, more or less biseriate and often diagonally arranged in the asci.

NOTES. – There are some discrepancies between our material and the protologue (Hawksworth 1975b), where the ascomatal setae were reported as being shorter (20–30 µm long), the interascal hyphae evanescent, the asci cylindrical and shorter (25–30 × 3.5–4 µm), and the ascospores smaller (4.5–8 × 1.5–2 µm). Our material was found on the podetia and occasionally basal squamules of *Cladonia amaurocraea*, *C. arbuscula*, *C. cornuta*, *C. gracilis*, *C. pyxidata*, *C. rangiferina*, *C. scabriuscula*, *C. stellaris*, *C. sulphurina* and *C. uncialis*. The species often occurs on moribund host thalli. Here we report *Niesslia cladoniicola* as new to the United States and Argentina. *Cladonia amaurocraea*, *C. cornuta*, *C. gracilis*, *C. scabriuscula*, *C. sulphurina* and *C. uncialis* are new host species.

Specimens examined. – **RUSSIA. KRASNOYARSK TERRITORY:** Severnaya Zemlya Archipelago, Bol'shevik Island, Mt. Bol'shaya, 78°12'N, 103°17'E, elev. 60 m, 10.viii.2000, on *C. uncialis* (bases of podetia), *N.V. Matveeva s.n.* (LE 308477); Western Sayan Mts., Ergaki Nature Park, Olen'ya River, 52°48'N, 93°15'E, elev. 1650 m, 11.vii.2010, on *C. sulphurina* (podetia), *M.P. Zhurbenko 1040* (LE 308678); Tushkanchik River, 52°47'N, 93°21'E, elev. 1150 m, 23.vii.2010, on *C. sulphurina* (podetia),

M.P. Zhurbenko 1046 (LE 308682). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Zabolochennaya River, 45°13'42.8"N, 136°31'04.5"E, elev. 150 m, 26.viii.2013, on *C. pyxidata* (basal squamules, podetia), *M.P. Zhurbenko 13159* (LE 308635). **KAMCHATKA TERRITORY:** Kamchatka Peninsula, Kronotsky Nature Reserve, Levaya Schapina River, 55°08'38"N, 159°59'24"E, elev. 370 m, 13.viii.2009, on *Cladonia* sp. (moribund podetia), *D.E. Himelbrant & I.S. Stepanchikova s.n.* (LE 308520a); **CHUKOTKA AUTONOMOUS AREA:** Innepinkul'veem River, on *C. stellaris* (podetia), 10.viii.1951, *Ababkov* (LE 308801); km 174 of road from Egvekinot to Iul'tin, 67°41'N, 178°35'W, 9.viii.1979, on *C. gracilis* (podetia), *I.I. Makarova s.n.* (LE 308823); Baranikha, 68°30'N, 168°16'E, 21.vi.1971, on *C. amaurocraea* (bases of podetia), *I.I. Makarova s.n.* (LE 308830). **U.S.A. ALASKA:** Kotzebue, 66°53'N, 162°31'W, elev. 30 m, 19.viii.2000, on *C. rangiferina* (podetia), *M.P. Zhurbenko 00121* (LE 309132); Seward Peninsula, Bering Land Bridge National Preserve, 65.3825°N, 163.7145°W, elev. 250 m, 13.vii.2002, on *C. cornuta* (moribund podetia), *T. Jorgenson s.n.* (LE 308575); Seward Peninsula, 7 km NE of Nome, Newton Peak, 64°33'21"N, 165°21'23"W, elev. 220 m, 4.ix.2001, on *C. pyxidata* (moribund podetia), *M.P. Zhurbenko 01643* (LE 308588); 7 km ESE of Nome, 64°28'44"N, 165°16'03"W, elev. 5 m, 1.ix.2001, on *C. rangiferina* (moribund podetia), *M.P. Zhurbenko 0142a* (LE 308589a); Kenai Peninsula, Chugach National Forest, 60°10'N, 149°30'W, elev. 150 m, 1.ix.2000, on *C. scabriuscula* (podetia), *M.P. Zhurbenko 00477* (LE 309133). **ARGENTINA. TIERRA DE FUEGO:** Paso Garibaldi, 54°40'S, 67°55'W, elev. 390 m, 29.ix.1969, on *C. arbuscula* (podetia), *H. Roivainen s.n.* (H).

***Niesslia keissleri* Zhurb., sp. nov.**
MycoBank #MB 819558

FIGURE 9

DIAGNOSIS. – Lichenicolous fungus. Differs from *Niesslia cladoniicola* in producing smaller, more or less immersed ascomata, typically 50–80 µm in diameter (vs. larger, superficial ascomata, 100–130 µm in diameter); setae that are typically isodiametric and usually up to 25 µm long, with a more or less rounded apex (vs. setae subulate that are more than 25 µm long, with an acute apex); narrower asci that are typically clavate with a rounded apex (vs. wider asci that are subcylindrical with a truncate apex); and wider, 0(–1)-septate ascospores that are (6.5–)9–12.5(–15) × (2–)3–4(–5) µm [vs. narrower, 1-septate ascospores that are (6.5–)8.5–10.5(–13) × (1.5–)2–2.5(–3) µm].

TYPE: **RUSSIA. Murmansk Region:** Khibiny Mts., Mt. Kukisvumchorr, 67°42'N, 33°36'E, elev. 450 m, 9.viii.1997, on *Cladonia mitis* (podetia), *M.P. Zhurbenko 9716* (LE 207224!, holotype; herb. Diederich!, isotype).

DESCRIPTION. – *Vegetative hyphae* not observed. *Ascomata* perithecioid, black, subglobose, (35–)53–77(–100) µm in diameter (n = 225), ostiolate, setose, protruding only in the ostiolar area to superficial, dispersed to occasionally adjacent. *Setae* dark reddish brown, markedly darker than the ascomatal wall, more or less isodiametric or occasionally subulate, straight to somewhat bent, slightly swollen at the base, with rounded apex, (5–)10–22(–39) × 3.5–4(–5) µm (n = 193, in water or K), not branched, wall 0.5–1 µm thick, aseptate; often exhibiting on squash mounts a characteristic dark crown around the ostiole; sometimes much reduced and almost inconspicuous under a dissecting microscope, particularly when ascomata grow on host thalli with a well-developed cortex. *Exciple* light to medium reddish brown outside (paler below), subhyaline inside, pigmentation homogeneous, K+ brownish gray, in cross-section 6–10 µm thick, composed of 3–4 layers of tangentially elongated cells, in surface view of *textura angularis*, of cells ca. 3–7 µm lengthways. *Periphyses* hyaline, ca. 5–7 µm long, septate. *Paraphyses* hyaline, filiform, slightly nodulose, apically not enlarged, 10–25 × 1–1.5(–2) µm, occasionally branched, clearly observed only in LE 207224. *Hymenial gel* I and K/I–. *Asci* clavate, obclavate or ellipsoid, rounded at the apex, usually with a short, broad stalk, with distinct tholus, occasionally with ocular chamber, (17–)22–39(–48) × (5–)6–10.5(–14) µm (n = 69, in water, BCr, I or K/I), 8-spored, BCr–, I and K/I–. *Ascospores* hyaline to light brown with age, narrowly ellipsoid or slightly wider in the upper half, (6.6–)9.1–12.3(–15.0) × (2.0–)2.8–4.2(–5.0) µm, l/b = (1.9–)2.7–3.7(–4.5) (n = 126, in water, BCr, K or K/I), 0(–1)-septate, not constricted at the septum, wall smooth or finely granulose with age, guttulate, non-halonate, irregularly 2–3-seriate in the ascus. *Anamorph* not found.

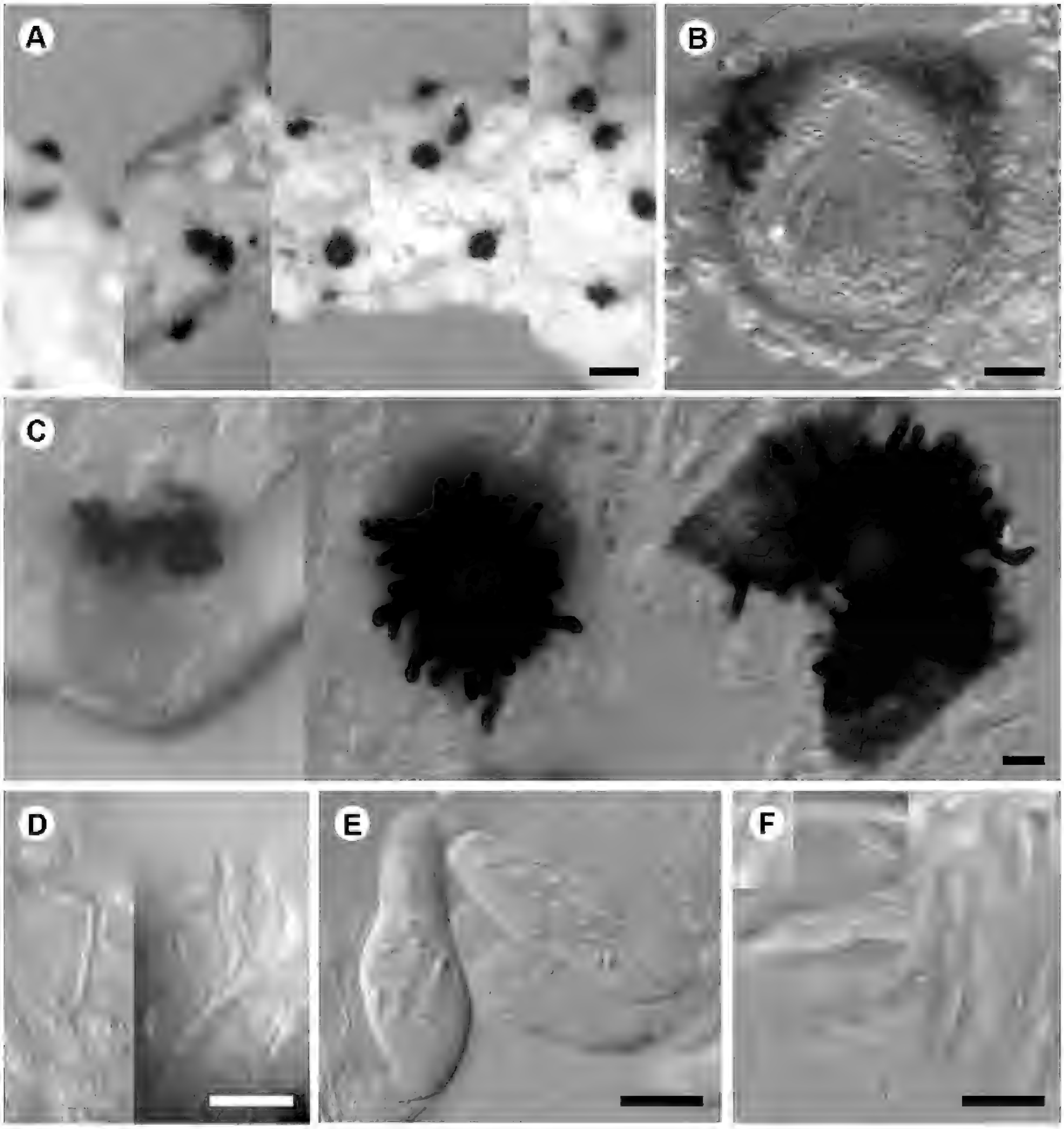

Figure 9. *Niesslia keissleri*. **A,** ascomata (LE 297219). **B,** ascoma in cross section in water (LE 308591). **C,** ascomatal setae at different stages of ascomata maturation in K (LE 308499). **D,** paraphyses in K (holotype). **E,** asci in K (LE 207219). **F,** ascospores in K (LE 308777). Scale bars: A = 100 µm, B–F = 10 µm.

ETYMOLOGY. – Named in honor of the eminent Austrian lichenologist and mycologist Karl von Keissler.

DISTRIBUTION AND HOSTS. – The species is widely distributed in the Holarctic and quite common, at least in its arctic and boreal regions (see Figure 15), though not known yet from the polar desert biome. We found this species mainly on podetia, often growing over their entire length up to the tips, occasionally on basal squamules, of *Cladonia amaurocraea*, *C. coccifera*, *C. cornuta*, *C. deformis*, *C. digitata*, *C. ecmocyna*, *C. furcata*, *C. gracilis*, *C. metacorallifera*, *C. mitis*, *C.* cf. *phyllophora*, *C. rangiferina*, *C. stellaris*, *C. stygia*, *C. sulphurina*, *C. umbricola*, *C. uncialis*, *Cladonia* spp. According to our observations

the fungus often produces rich populations and is occasionally associated with slightly bleached portions of the host thalli.

DISCUSSION. – Compared to the 13 species of *Niesslia* Auersw. so far known to be lichenicolous (Lawrey & Diederich 2016) the new species is somewhat unusual because of its more or less isodiametric setae (vs. typically subulate setae), an exciple of *textura angularis* (vs. *textura epidermoidea*), presence of paraphyses in mature ascomata, and ascospores that become occasionally pigmented and granulose with age. However, the setae of *N. keissleri* are occasionally also subulate, paraphyses have been observed in *N. cladoniicola* (see above) and in *N. tetraedrispora* Etayo (Etayo 2002), and pigmented or granulose overmature ascospores are known in *N. peltigericola* (D. Hawksw.) Etayo (Zhurbenko 2009b) and *N. pseudocyphellariae* Etayo & Diederich (Etayo 2000) respectively. A detailed comparison with *N. cladoniicola*, the second cladoniicolous species of the genus, is given in the diagnosis above and in the key below.

Without a proper morphological description and designation of a type, Keissler (1930: 330) introduced a provisional name '*Echinothecium cladoniae* nov. spec. ad interim' based on several specimens of a setose pyrenomycete from Germany growing on *Cladonia* species. Though Keissler failed to find asci and ascospores in this material, he suggested that it was congeneric with *E. reticulatum* Zopf, differing from the latter in the non-septate, larger and sinuous ascomatal setae and different host genus (*Cladonia*). The new species is probably conspecific with the material examined by Keissler. However, according to the Article 36 [see for instance Ex. 6(b)] of the *Melbourne Code* (McNeill et al. 2012) the name '*Echinothecium cladoniae* nov. spec. ad interim' is not validly published, and therefore a new species is described here. Its placement in the genus *Echinothecium* Zopf would be very doubtful, since the type of that genus, *E. reticulatum*, is quite different from *N. keissleri* and has recently been combined into another genus as *Sphaerellothecium reticulatum* (Zopf) Etayo (Etayo 2008). The latter species has well-developed, branched vegetative hyphae, that form a conspicuous dark superficial net on the host thalli. Furthermore its ascomata do not have true setae, but instead are covered by aerial septate hyphae that grow up and then fall downward, similar to net-forming vegetative hyphae (Navarro-Rosinés & Gómez-Bolea 1989: Fig. 2A, B). It should be noted that one collection cited below (*Yakovchenko s.n.*, LE 261004) was formerly identified and published as *N. cladoniicola* by Zhurbenko and Yakovchenko (2014).

Additional specimens examined. – **RUSSIA. MURMANSK REGION:** Khibiny Mts., Mt. Kukisvumchorr, 67°40'N, 33°40'E, elev. 500 m, 13.viii.1997, on *Cladonia stellaris* (podetia), *M.P. Zhurbenko 97421* (LE 308931); Kaskasnyunjok Creek, 67°46'N, 33°49'E, 18.viii.2007, on *C. stellaris* (podetia), *M.P. Zhurbenko 0766a* (LE 210308a); Ponoi, 67°04'34"N, 41°07'34"E, elev. 50 m, 6.viii.1972, on *C. amaurocraea* (podetia), *A.V. Dombrovskaya s.n.* (LE 308905). **NENETS AUTONOMOUS AREA:** Bol'shezemel'skaya tundra, Khar'yaga oilfield, 67º10'30"N, 56º37'51"E, elev. 70 m, 18.vii.2007, on *C. amaurocraea* (podetia), *M.P. Zhurbenko 0744* (LE 308505); Ortin River, 67°50'04"N, 54°04'35"E, 28.vi.1999, on *C. metacorallifera* (basal squamules, podetia), *O.V. Lavrinenko s.n.* (LE 308928); Khabuikato Lake, 68°32'14"N, 53°50'45"E, 5.vii.1999, on *C. amaurocraea* (podetia), *O.V. Lavrinenko s.n.* (LE 308933). **KOMI REPUBLIC:** Kazhym, 60°19'58"N, 51°32'00"E, 14.x.1988, on *C. digitata* (podetia), *E.N. Melekhina s.n.* (LE 308875a), 12.vii.1989, on *C. rangiferina* (old parts of podetia), *E.N. Melekhina s.n.* (LE 308854); Northern Ural, Yanypupuner Range, 62°05'N, 59°06'E, elev. 800 m, 3.vii.1997, on *C. mitis* (podetia), *M.P. Zhurbenko 97242a* (LE 210227a); 3.vii.1997, on *C. amaurocraea* (podetia), *M.P. Zhurbenko 97241a* (LE 210225a). **TYUMEN' REGION:** Polar Ural, Mt. Rai-Iz, 66°52'N, 65°05'E, elev. 700 m, 4.ix.2001, on *C. furcata* (podetia), *S.S. Kholod s.n.* (LE 308574a); Yamal Peninsula, Kharasavey, 71°10.723'N, 66°58.772'E, 20.viii.2008, on *C. gracilis* (podetia), *D.A. Walker s.n.* (LE 308569); Nadym, 65°18.9'N, 72º51.8'E, 10.viii.2007, on *C. amaurocraea* (podetia), *D.A. Walker s.n.* (LE 308506); Saletayakha River, 69°45'N, 68°40'E, 12.viii.1990, on *C. furcata* (podetia), *O.V. Rebristaya s.n.* (LE 308813). **KRASNOYARSK TERRITORY:** Gydan Peninsula, Leskino, 72°20'N, 79°30'E, 16.viii.1972, on *C. furcata* (podetia), *R.I. Yunak & G.I. Prokop'eva s.n.* (LE 308838); Western Sayan Mts., Ergaki Nature Park, Bol'shaya Baklanikha River, 52°46'N, 93°19'E, elev. 1150 m, 24.vii.2010, on neighbouring *C. coccifera* and *C. sulphurina* (podetia), *M.P. Zhurbenko 1051b* (LE 308686b); Olen'ya River, 52°48'N, 93°15'E, elev. 1500 m, 11.vii.2010, on *C. sulphurina* (basal squamules, podetia), *M.P. Zhurbenko 1045* (LE 308681); Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 54°00'N, 95°29'E, elev. 1400 m, 20.vii.2009, on *Cladonia* sp. (basal squamules, occasionally podetia), *M.P. Zhurbenko 0967* (LE 308668); on *C. rangiferina* (podetia), *M.P. Zhurbenko 0945b* (LE 308652b); 53°59'N, 95°25'E, elev. 1550 m,

5.vii.2009, on *C. digitata* (basal squamules, podetia), *M.P. Zhurbenko 0947a* (LE 308654a); elev. 1400 m, 7.vii.2009, on *C. phyllophora* (basal squamules, podetia), *M.P. Zhurbenko 0946a* (LE 308653a). **REPUBLIC OF TUVA:** Todzhinskaya trough, headwaters of Dugdu River, on *C. deformis* (basal squamules, podeia), 24.vii.1999, *N. I. Molokova* (LE 210263a). **REPUBLIC OF ALTAI:** Ukok Plateau, ca. 49°18'N, 87°36'E, elev. 2400 m, 22.vii.1996, on *C. amaurocraea* (podetia), *T. Lunke 451a* (LE 308865). **TRANS-BAIKAL TERRITORY:** Sokhondinskii Reserve, Bukukunskoe Lake, 49°42.474'N, 111°04.749'E, elev. 2295 m, 24.vii.2005, on *C. furcata* (moribund podetia), *L.S. Yakovchenko s.n.* (LE 261004). **REPUBLIC OF SAKHA (YAKUTIA):** without location, 26.vii.1964, on *C. cariosa* (podetia), *V.I. Perfil'eva s.n.* (LE 308766). **KHABAROVSK TERRITORY:** Ayano-Maiskii District, Vatom River, 2.vii.1912, on *C. amaurocraea* (podetia), *F.V. Sokolov s.n.* (LE 308888b). **MAGADAN REGION:** Tal'skii pass, 61°11'N, 152°06'E, elev. 1050 m, 27.vii.1992, on *C. amaurocraea* (podetia), *M.P. Zhurbenko 92567* (LE 308901). **CHUKOTKA AUTONOMOUS AREA:** Mt. Pynei, 3.vi.1951, on *C. amaurocraea* (podetia), *I. Shmorunova s.n.* (LE 308810a); Iskaten' pass, 66°35'N, 179°10'E, tundra, 6.viii.1971, on *C. amaurocraea* (podetia), *I.I. Makarova s.n.* (LE 308807); hot springs at Gil'mymlineiveem River, 65°48'N, 173°15'W, 26.vii.1977, on *C. ecmocyna* (podetia), *I.I. Makarova s.n.* (LE 308777); Mt. Ioni, 65°55'N, 173°41'W, elev. 650 m, 7.vii.1977, on *C. furcata* (podetia), *I.I. Makarova s.n.* (LE 308831); Zaliv Kresta, 66°21'N, 179°06'W, 22.vii.1951, on *C. amaurocraea* (podetia), *Berezina s.n.* (LE 308794); Baran'e Lake, 66°54'N, 175°15'E, 24.vii.1980, on *C. coccifera* (podetia), *I.I. Makarova s.n.* (LE 308788); headwaters of Utesiki River, 21.viii.1948, on *C. amaurocraea* (podetia), *M.N. Avramchik s.n.* (LE 308773b), on *C. uncialis* (podetia), *M.N. Avramchik s.n.* (LE 308804). **U.S.A. ALASKA:** Great Kobuk Sand Dunes, 67°07'N, 159°03'W, elev. 40 m, 9.viii.2000, on *C. rangiferina* (podetia), *M.P. Zhurbenko 00474* (LE 309061); Fairbanks, 64°51.956'N, 147°52.494'W, elev. 170 m, 14.viii.2004, on *C. cornuta* (podetia), *M.P. Zhurbenko 04154b* (LE 309127b); 64°49.236'N, 147°45.498'W, 3.viii.2004, on *C. rangiferina* (podetia), *M.P. Zhurbenko 0476b* (LE 309053b); 64°52'N, 147°52'W, elev. 154 m, 2003, on *C. gracilis* (podetia), *T. Hollingsworth s.n.* (LE 308499); Goldstream Valley, 64°57.188'N, 147°42.775'W, 31.vii.2004, on *C. cornuta* (podetia), *M.P. Zhurbenko 0468a* (LE 309060a), 12.viii.2004, on *C. stellaris* (podetia), *M.P. Zhurbenko 04140* (LE 309056); Skyline Ridge, 64°55.270'N, 147°43.001'W, elev. 470 m, 31.vii.2004, on *C. gracilis* (podetia), *M.P. Zhurbenko 04378* (LE 309055a); on *C. cornuta* (podetia), *M.P. Zhurbenko 0449* (LE 309059); Tanana River, Bonanza Creek, 64°51.320'N, 147°49.189'W, elev. 130 m, 21.viii.2004, on *C. gracilis* (podetia), *M.P. Zhurbenko 04379* (LE 309058); on *C. cornuta* (podetia including podetial squamules), *M.P. Zhurbenko 04265a* (LE 309057a); Denali National Park and Preserve, Hinnes Creek, 63°43'N, 149°07'W, elev. 900 m, 30.viii.2000, on *C. stygia* (moribund podetia), *M.P. Zhurbenko 00304c* (LE 309147c); 30.viii.2000, on *C. sulphurina* (podetia), *M.P. Zhurbenko 00311* (LE 308591). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Spahats Creek, 51°44'23"N, 120°00'23"W, elev. 770 m, 10.vii.2002, on *Cladonia* sp. (podetia), *M.P. Zhurbenko 02281a* (LE 308727a); Philip Creek, 52°52'N, 120°00'W, elev. 800 m, 30.vii.2002, on *C.* cf. *phyllophora* (podetia), *M.P. Zhurbenko 02155b* (LE 308704b); Columbia Mts., Beaver River, 51°15'N, 117°22'W, elev. 1150 m, 17.vii.2002, on *C. umbricola* (basal squamules, podetia), *M.P. Zhurbenko 02100b* (LE 308743); 51°18'N, 117°24'W, elev. 1100 m, 17.vii.2002, on *C. sulphurina* (podetia), *M.P. Zhurbenko 0215a* (LE 308706a).

Specimen of Echinothecium reticulatum *examined for comparison:* **RUSSIA. CHUKOTKA AUTONOMOUS AREA:** Lavrentiya Bay, 65°35'N, 171°00'W, boulder field in tundra, 21.vii.1973, on *Parmelia saxatilis* (thallus), *I.I. Makarova s.n.* (LE 233319).

***Opegrapha cladoniicola* Ertz & Diederich**

NOTES. – The examined material fits the protologue (Ertz & Diederich 2003) except for the ascospores, which are 3–7-transseptate (vs. 3-septate) and larger (16.5–27.6 × 4.1–4.9 µm vs. 14–17 × 5–6 µm in the protologue). The species was previously known only from the type specimen collected in Hawaii on *Cladonia ochrochlora* (Ertz & Diederich 2003). Here we report it for the first time from Papua New Guinea and *Cladonia fruticulosa* is a new host.

Specimen examined. – **PAPUA NEW GUINEA. MOROBE PROVINCE:** Heads Hump, 6 km SE of Bulolo, 7°13'S, 146°42'E, elev. 1000 m, 7.iii.1982, on *Cladonia fruticulosa* (podetia), *H. Streimann 17353* (H, LE 309450).

Pezizella ucrainica **S.Y. Kondr.**

NOTES. – The specimens examined for this study differ from the protologue as follows: the ascomata are medium orange yellow (vs. pale straw yellow) and up to 150 µm in diameter (vs. up to 270 µm in diameter), the asci are subcylindrical and slightly longer [35–43 × 4–6 µm (n = 8, in K/I) vs. 21–27 × 3.5–5.5 µm], and the ascospores are slightly shorter [5.0–6.3 × 1.6–2.3 µm (n = 9, in K/I) vs. 5–8 × 1–2.5 µm] (Kondratyuk & Galloway 1995). Additionally, we observed that in our material the hymenium is K/I– and the asci have a K/I+ blue apical ring, which has not been mentioned before. Kondratyuk (2010) proposed the combination *Calycina ucrainica* (S.Y. Kondr.) S.Y. Kondr., however provided no justification for this decision and thus we retain the species provisionally in *Pezizella*. Here we report the species for the first time from Asia and Russia.

Specimen examined. – **RUSSIA. PRIMORYE TERRITORY:** Sikhote-Alin' Range, Kabanii Creek, 45°06'35"N, 135°52'01"E, elev. 490 m, mixed forest, 5.ix.2013, on *Cladonia* sp. (moribund basal squamules) growing on decaying wood, *M.P. Zhurbenko 13149* (LE 264267).

Phaeopyxis punctum **(A. Massal.) Rambold, Triebel & Coppins**

DESCRIPTION. – *Apothecia* black or sometimes medium or dark brown, shiny, initially completely immersed with concave or plane disc not protruding above the level of the host thallus, finally superficial, constricted at the base, usually more or less rounded in surface view, with plane disc and more or less distinct margin, 50–250 µm in diameter, often abundant, dispersed, sometimes contiguous; when destroyed leaving deep holes in the host thallus. *Epihymenium* medium to dark grayish red (intensifying in K), reddish brown, dark vinaceous, purplish brown or occasionally almost black, pigmentation very dense, 3–8 µm tall. *Hymenium* colorless or sometimes with scattered violet tinge, becoming light or medium reddish brown when old, 30–50 µm tall; hymenial gel I and K/I–. *Paraphyses* septate, 2–2.5 µm in diameter, sometimes up to 3 µm in diameter at the apex, occasionally branched, embedded in a transparent gelatinous substance. *Subhymenium* colorless or light reddish brown, of *textura globulosa*, up to 30 µm tall. *Exciple* cupulate, medium to dark reddish or orangish brown, blackish gray, bluish olive or olive brown, pigmentation patchy, 10–20 µm thick laterally, 15–30 µm thick basally. Grayish or purplish red tinge of the ascomatal section becomes more pronounced in K. *Asci* non-fissitunicate, clavate to occasionally subcylindrical, (35–)42–52.5(–55) × (8–)8.5–10.5(–11.5) µm (n = 19), wall evenly I+ very pale blue, K/I+ pale blue, 1–2 µm thick laterally, apically up to 3 µm thick and often slightly inwardly concave, 8-spored; the ascoplasm sometimes light reddish brown. *Ascospores* hyaline or sometimes becoming light reddish brown even within the asci, narrowly ellipsoid, (7.2–)8.6–10.2(–11.0) × (2.7–)3.1–3.5(–3.8) µm, l/b = (2.2–)2.6–3.2(–3.5) (n = 56, in water or I), aseptate, smooth-walled, non-halonate, diagonally biseriate in the ascus. Subglobose, more or less immersed pycnidia 40–110 µm in diameter, with hyaline, oblong conidia rounded at the apex and truncated at the base, (2.9–)3.4–4.6(–6.4) × (1.3–)1.4–1.6(–1.8) µm, l/b = (1.9–)2.3–3.1(–4.1) (n = 130), were associated with the species ascomata in LE 308691a and 308874a.

NOTES. – This species was found on the podetia and/or basal squamules of *Cladonia albonigra*, *C. amaurocraea*, *C. botrytes*, *C. carneola*, *C. cenotea*, *C. chlorophaea* s. lat., *C. coniocraea*, *C. deformis*, *C. didyma*, *C. digitata*, *C. gracilis*, *C. macilenta*, *C. mitis*, *C.* cf. *ochrochlora*, *C. pocillum*, *C. rangiferina*, *C. stellaris*, *C. subulata*, *C. sulphurina*, *C. umbricola*, *C. ustulata* and unidentified *Cladonia* species, often growing on rotten wood. It was occasionally associated with bleached or darkened host parts, and once (in LE 308820) was found on gall-like swellings of the host thallus. This conspicuous, common and frequently reported species seems to avoid the Arctic, where it is so far known just from two finds in the tundra biome (Zhurbenko 2008, and herein). Here we report this species for the first time from Mongolia. *Cladonia albonigra*, *C. arbuscula*, *C. carneola*, *C. deformis*, *C. didyma*, *C. rangiferina*, *C. stellaris*, *C. subulata*, *C. sulphurina* and *C. ustulata* are new host species.

Specimens examined. – **FINLAND. UUSIMAA:** Vantaa, Koivukylä, 8.vi.2014, on *Cladonia mitis* (podetia), *R. Pino-Bodas s.n.* (H); **TAVASTIA PROPER:** Hämeenlinna, Lammi, 61º05'N, 24º58'E, 13.viii.2013, on *C. coniocraea* (squamules), *V. Haikonen 29409a* (H). **RUSSIA. KOMI REPUBLIC:** Kazhym, 60°19'58"N, 51°32'00"E, 14.x.1988, on *C. digitata* (podetia), *E.N. Melekhina s.n.* (LE 308875b); Northern Ural, Yanypupuner Range, 62°05'N, 59°06'E, elev. 800 m, 3.vii.1997, on *C. amaurocraea* (podetia), *M.P. Zhurbenko 97241b* (LE 210225b). **TYUMEN' REGION:** Polar Ural, Mt. Chernaya, 66°48'N, 65°30', elev. 250 m, 28.vii.2004, on *C. amaurocraea* (podetia), *S.S. Kholod s.n.* (LE 308579).

KRASNOYARSK TERRITORY: Gydan Peninsula, Leskino, 72°20'N, 79°30'E, 1972, on *C. rangiferina* (on gall-like swellings on podetia), *R.I. Yunak & G.I. Prokop'eva s.n.* (LE 308820); Western Sayan Mts., headwaters of Sinyaya River, elev. 2350 m, 22.viii.1991, on *Cladonia* sp. (basal squamules), *V.B. Kuvaev 2104* (LE 308862); Ergaki Nature Park, Tushkanchik River, 52°47'N, 93°21'E, elev. 1150 m, 23.vii.2010, on *C. sulphurina* (basal and podetial squamules), *M.P. Zhurbenko 1049* (LE 309311); Turukhansk Region, Zotino, 61ºN, 89º50'E, elev. 100 m, 21.viii.1979, on *C. botrytes* (basal squamules), *V.B. Kuvaev s.n.* (LE 308924a). **IRKUTSK REGION:** 2 km SE of Anchuk, Bol'shaya Bystraya River, 51º44'N, 103º29'E, elev. 700 m, 9.vi.2005, on *C. coniocraea* (podetial squamules), *M.P. Zhurbenko 0563a* (LE 309109); Khamar-Daban Range, Snezhnaya River, 51º23'N, 104º39'E, elev. 550 m, 17.vi.2005, on *C. digitata* (basal and podetial squamules), *M.P. Zhurbenko 05114* (LE 309108). **REPUBLIC OF BURYATIA:** SE coast of Baikal Lake, 5 km SW of Turka, 52°50'50"N, 108°00'50"E, elev. 460 m, 25.viii.2002, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 02406* (LE 309107). **TRANS-BAIKAL TERRITORY:** Sokhondinskii Reserve, Verkhnii Bukukun, 49°37'34"N, 111°02'12"E, elev. 1775 m, 23.viii.2005, on *C. stellaris* (podetia), *L.S. Yakovchenko s.n.* (LE 308544). **KHABAROVSK TERRITORY:** Ayano-Maiskii District, Vatom River, 2.vii.1912, on *C. amaurocraea* (podetia), *F.V. Sokolov s.n.* (LE 308888a). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Kabanii Creek, 45°06'35"N, 135°52'01"E, elev. 490 m, 5.ix.2013, on *C. coniocraea* (basal and occasionally podetial squamules), *M.P. Zhurbenko 13167c* (LE 308649c), *M.P. Zhurbenko 13146* (LE 308640); Sikhote-Alin' Range, Zabolochennaya River, 45°14'07"N, 136°30'34"E, elev. 160 m, 22.viii.2013, on *C. coniocraea* (basal and podetial squamules), *M.P. Zhurbenko 13163* (LE 308641); Sikhote-Alin' Range, Yasnaya River, 45°14'22"N, 136°29'22"E, elev. 160 m, 24.viii.2013, on *C. macilenta* (basal squamules), *M.P. Zhurbenko 13162* (LE 308638); Sikhote-Alin' Range, Valinku River, 46.1315°N, 136.6985°E, elev. 1450 m, 25.viii.2013, on *C. digitata* (basal and podetial squamules), *Yu.V. Gerasimova s.n.* (LE 308646); 46.2173°N, 136,6922°E, elev. 1040 m, 28.viii.2013, on *C. coniocraea* (basal and podetial squamules), *Yu.V. Gerasimova s.n.* (LE 308645). **MAGADAN REGION:** Kamennyi Range, 59°45'25"N, 149°39'18"E, elev. 9 m, viii.2013, on *C. pocillum* (basal squamules), *I.A. Galanina s.n.* (LE 308692). **KAMCHATKA TERRITORY:** Kamchatka Peninsula, Kronotsky Nature Reserve, Levaya Schapina River, 55°08'29"N, 159°58'17"E, elev. 340 m, 12.viii.2009, on *C. gracilis* (podetia), *D.E. Himelbrant & I.S. Stepanchikova s.n.* (LE 309166). **MONGOLIA. ARA-KHANGAI AIMAK:** watershed of Khukh-Sumein-Gol and Tsetserleg-Gol Rivers, Mt. Khairkhan, 47º15'N, 101º50'E, elev. 2400 m, 28.vii.1979, on *C. subulata* (basal squamules), *L.G. Biazrov 3487b* (LE 308866b); headwaters of Khukh-Sumein-Gol River, 16.vii.1971, on *C. chlorophaea* s. lat. (basal squamules), *L.G. Biazrov 1627a* (LE 308874a), 22.vii.1970, *L.G. Biazrov 1690a* (LE 308840a). **BULGAN AIMAK:** 11 km N of Bugat, 49º10'N, 103º45'E, elev. 1270 m, 27.vii.1977, on *C. coniocraea* (basal and podetial squamules), *L.G. Biazrov 6773* (LE 308847). **U.S.A. ALASKA:** Great Kobuk Sand Dunes, 67°05'N, 158°55'W, elev. 50 m, 2.viii.2000, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 0029* (LE 309310); Goldstream Valley, 64°57.188'N, 147°42.775'W, 31.vii.2004, on *C. cenotea* (podetia), *M.P. Zhurbenko 0463* (LE 309113); Fairbanks, 14.viii.2004, on *C. cenotea* (podetia), *M.P. Zhurbenko 04149* (LE 309111); Denali National Park and Preserve, Rock Creek, 63°43.35'N, 148°57.53'W, elev. 670 m, 17.viii.2004, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 04209a* (LE 309112a), 20.viii.2004, *M.P. Zhurbenko 04182* (LE 309114); Kenai Peninsula, Chugach National Forest, 60°10'N, 149°30'W, elev. 150 m, 1.ix.2000, on *Cladonia* sp. (podetial and basal squamules), *M.P. Zhurbenko 00476* (LE 309115). **CANADA. YUKON TERRITORY:** Pine Lake Campground, 60º48'13"N, 137º26'03"W, elev. 670 m, 7.vi.2011, on *C. carneola* (basal squamules), *J.C. Lendemer 29127a* (H). **BRITISH COLUMBIA:** Wells Gray Provincial Park, Mt. Trophy, 7.vii.2002, on *C. sulphurina* (basal and occasionally podetial squamules), *J. Miadlikowska s.n.* (LE 308738); Philip Creek, 52°52'N, 120°00'W, elev. 800 m, 30.vii.2002, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 02165* (LE 308711); Battle Creek, elev. 750 m, 5.viii.2002, on *Cladonia* sp. (basal and podetial squamules), *M.P. Zhurbenko 02369* (LE 308708), *M.P. Zhurbenko 02370* (LE 308713); on *C.* cf. *ochrochlora* (basal and podetial squamules), *M.P. Zhurbenko 02368* (LE 308716), *M.P. Zhurbenko 02371* (LE 308714); Clearwater River, 51°43'16"N, 120°01'25"W, elev. 550 m, 14.vii.2002, on *C. deformis* (basal squamules), *J. Miadlikowska s.n.* (LE 308759c); Columbia Mts., Beaver River, 51°18'N, 117°24'W, elev. 1100 m, 16.vii.2002, on *C. sulphurina* (podetial squamules), *M.P. Zhurbenko 0298a* (LE 308748a); 17.vii.2002, *M.P. Zhurbenko 0215b* (LE 308706b); 51°15'N, 117°22'W, elev. 1150 m, 17.vii.2002, on *C. umbricola* (basal squamules), *M.P. Zhurbenko 02100e* (LE 308742); Mount Revelstoke National Park, Mt. Revelstoke, elev. 700 m, 19.vii.2002, on *C. albonigra* (basal and podetial squamules), *M.P. Zhurbenko 0211* (LE 308744). **SASKATCHEWAN:** Creighton, 54°49'34"N, 102°02'23"W, elev. 350 m, 24.v.2004, on *C. botrytes* (basal squamules), *T. Ahti 62967* (H). **VENEZUELA. TRUJILLO:** Páramo de Guaramacal,

elev. 2750 m, 9.viii.1975/1977, on *C. didyma* (podetial squamules), *M. López Figueiras 10227a* (H); *M. López Figueiras 10382a* (H). **NEW ZEALAND. SOUTH ISLAND:** Kahurangi National Park, Mt. Arthur, 41.19°S, 172.75°E, 16.v.2011, on *C. ustulata* (primary thallus), *S. Stenroos 6040a* (H).

***Phoma grumantiana* Zhurb. & Diederich**

NOTES. – Formerly known in the United States only from Alabama (Diederich et al. 2007), we report this species for the first time from Alaska.

Specimen examined. – **U.S.A. ALASKA:** Denali National Park and Preserve, 63°43.35'N, 148°57.53'W, elev. 650 m, mixed *Picea glauca* forest, 20.viii.2004, on *Cladonia pocillum* (basal squamules), *M.P. Zhurbenko 04169* (LE 309150).

***Plectocarpon cladoniae* R. Sant.**

NOTES. – This species has previously been reported in Russia only from the Murmansk Region and Karelia Republic (Zhurbenko & Alstrup 2004, Zhurbenko & Himelbrant 2002). Here we report it from two additional locations and report it for the first time from Asia.

Specimens examined. – **RUSSIA. REPUBLIC OF KARELIA:** coast of Kandalaksha Bay of the White Sea, 15 km of Poyakonda, 66º34'N, 33º08'E, elev. 5 m, 15.viii.1964, on *Cladonia* sp. (basal squamules), *T. Piin s.n.* (LE 308925). **TRANS-BAIKAL TERRITORY:** Kodar Range, Olenii Rog Creek, 56°47'57"N, 117°21'59"E, elev. 1674 m, 18.vi.2015, on *Cladonia* sp. (basal squamules), *L.A. Konoreva s.n.* (LE 309332a).

***Polycoccum laursenii* Zhurb.**

NOTES. – In the specimen cited below the ascospores were light to medium brown, clavate to narrowly obovate (with wider upper cell) or occasionally almost homopolar, (0–)1(–3)-septate, and (6.7–)8.4–10.6(–14.0) × (2.8–)3.7–4.7(–5.6) µm in size [l/b = (1.7–)2.0–2.6(–3.4); n = 70]. In the protologue the ascospores were reported as always being heteropolar and only 1-septate (Zhurbenko & Alstrup 2004). Previously, the species was known only from the type locality in subarctic Alaska. Here we report it for the first time from Asia and Russia.

Specimen examined. – **RUSSIA. KHABAROVSK TERRITORY:** Bol'shekhekhtsirskii Reserve, Sosnenskii Creek, 48°14'46"N, 134°46'45"E, elev. 340 m, 2.viii.2013, open boulder field in mixed forest, on *Cladonia* sp. (basal squamules, podetia), *M.P. Zhurbenko 13161* (LE 308637).

***Polycoccum microcarpum* Diederich & Etayo**

NOTES. – There are several essential discrepancies between our material and the protologue (Etayo & Diederich 1998), where this species was described as having smaller ascomata (mainly 30–60 µm in diameter), tightly aggregated in groups of 20–80 on galls induced on *Cladonia* squamules, shorter asci (30–35 × 15 µm), and ascospores without distinct ornamentation. In our material the ascomata are mainly 50–70 µm in diameter, immersed to slightly protruding and aggregated in groups, the asci are 40–50 × 12–14 µm (n = 7, in I), and the ascospores are initially hyaline, then medium brown, narrowly obovoid with a wider and sometimes longer upper cell (ratio up to 3:2), 1-septate or very exceptionally with an additional septum in the upper cell, usually constricted at the septa, verruculose, without halos, and measure (11.8–)12.9–14.9(–17.0) × (4.5–)5.0–6.2(–7.4) µm in size [l/b = (2.1–)2.3–2.7(–3.2); n = 65].

Flakus et al. (2008) also reported that some of the ascospores of this species can be verruculose and up to 17 µm long, the asci are up to 55 × 15 µm and the ascomata are up to 120 µm in diameter. *Polycoccum cladoniae* Diederich & D. Hawksw., which also occurs on *Cladonia*, has similarly sized ascospores [13.5–16.5(–22) × 6.5–8(–9) µm], which are also 1-septate and verruculose, but readily differs in having more or less superficial and much larger ascomata (100–250 µm in diameter) (Hawksworth & Diederich 1988).

We found this species on the podetia of *Cladonia gracilis* (mainly ssp. *vulnerata*) where it caused light to strong bleaching. Swellings of the host thallus and gall-formation were not observed. This is the first report of the taxon from North America.

Specimens examined. – **U.S.A. ALASKA:** Kotzebue, 66°53'N, 162°31'W, elev. 30 m, 19.viii.2000, on *Cladonia gracilis* ssp. *vulnerata* (podetia), *M.P. Zhurbenko 00233b* (LE 309149), *M.P. Zhurbenko 00243a* (LE 308592a); Great Kobuk Sand Dunes, 67°07'N, 159°03'W, elev. 50 m, 9.viii.2000, on *C. gracilis* (podetia), *M.P. Zhurbenko 00473* (LE 308512), *M.P. Zhurbenko 00180c* (LE 308507c); Seward Peninsula, near Nome, 64°28'44"N, 165°16'03"W, elev. 5 m, 1.ix.2001, on *C. gracilis* ssp. *vulnerata* (podetia), *M.P. Zhurbenko 0199b* (LE 308586); 7 km NE of Nome, Newton Peak, 64°33'21"N, 165°21'23"W, elev. 220 m, 4.ix.2001, on *C. gracilis* ssp. *vulnerata* (podetia), *M.P. Zhurbenko 0197a* (LE 308593a).

Pronectria tibellii **Zhurb.**

NOTES. – This species is known only from a few occurences in the United States and Russia (Alstrup et al. 2005, Zhurbenko 2009b, Zhurbenko & Alstrup 2004).

Specimen examined. – **RUSSIA. KRASNOYARSK TERRITORY:** Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 54°00'N, 95°29'E, elev. 1400 m, 20.vii.2009, on *Cladonia pocillum* (basal squamules, podetia), *M.P. Zhurbenko 0973* (LE 308673).

Pronectria **sp.**

NOTES. – The specimen cited below is characterized by having ascomata 75–100 µm in diameter, with exposed upper parts that are light to medium reddish brown in color, walls that are orange-brown and do not change color in lactic acid. The asci are 8-spored, and the ascospores are hyaline, subfusiform, sometimes with slightly wider upper cell, smooth-walled, guttulate, and (11.0–)12.7–17.5(–19.2) × (2.7–)3.0–3.4(–3.6) µm in size [l/b = (3.4–)3.8–5.6(–6.8); n = 22, in water or lactic acid]. It is possible that the material represents a deviating specimen of *Pronectria tibellii* with smooth and comparatively long and narrow ascospores (see notes on this species above). Further study is needed.

Specimen examined. – **RUSSIA. PRIMORYE TERRITORY:** Sikhote-Alin' Range, Mt. Lysaya, 45°00'14"N, 136°30'00"E, elev. 850 m, 2.ix.2013, on *Cladonia mitis* (podetia), *M.P. Zhurbenko 13151b* (LE 308497b).

Protothelenella leucothelia **(Nyl.) H. Mayrhofer & Poelt**

NOTES. – This is a lichen that mainly grows on bryophytes, but also occurs on moribund thalli of other lichens, especially species of *Cladonia*. We found it on moribund podetia of *Cladonia arbuscula*, *C. mitis* and *C. stygia*.

Specimens examined. – **U.S.A. ALASKA:** Kobuk Valley Wilderness, Waring Mts., 66°59'N, 158°47'W, elev. 300 m, 31.vii.2000, on *Cladonia arbuscula* (moribund podetia), *M.P. Zhurbenko 00479* (LE 309146); Denali National Park and Preserve, Hinnes Creek, 63°43'N, 149°07'W, elev. 900 m, 30.viii.2000, on *C. stygia* (moribund podetia), *M.P. Zhurbenko 00129* (LE 308570), *M.P. Zhurbenko 00304a* (LE 309147a). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Mt. Raft, 51°44'N, 119°50'W, elev. 2100 m, 3.viii.2002, on *C. mitis* (podetia), *M.P. Zhurbenko 02349* (LE 308746).

Protothelenella santessonii **H. Mayrhofer**

NOTES. – In the specimens examined the ascospores were usually ellipsoid to narrowly ellipsoid, with mostly acute apices, sometimes attenuated and/or with apiculi, with (0–)3–5(–7) transversal or oblique septa and usually one longiseptum in central segments, and measured (14.4–)19.4–26.0(–31.6) × (6.0–)8.3–11.3(–16.2) µm, l/b = (1.5–)1.9–2.7(–3.4) (n = 120, measured with apiculi). This species is known from many reports on *Cladonia* species, but was also once reported on *Solorina crocea* (Alstrup & Cole 1998). Our material was found on the basal squamules and/or podetia of *Cladonia coccifera*, *C. pocillum*, *C. pyxidata*, *C. stricta*, *C. stygia* and unidentified *Cladonia* species. *Cladonia stricta* and *C. stygia* are new host species. We observed that occasionally the fungus caused distinct bleaching of the host tissues.

Specimens examined. – **NORWAY. SVALBARD:** Aldegondabreen glacier, 78º00'N, 14º12'E, elev. 50 m, 16.vii.2003, on *Cladonia* cf. *stricta* (moribund podetia), *M.P. Zhurbenko 03454* (LE 308502), 15.vii.2003; on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 03179* (LE 308578). **RUSSIA. KRASNOYARSK TERRITORY:** Severnaya Zemlya Archipelago, Bol'shevik Island, Cape Antsev,

78°13'N, 103°15'E, 7.viii.1997, on *C. coccifera* (podetia), *N.V. Matveeva s.n.* (LE 308881); Taimyr Peninsula, Uboinaya River, 73°39'N, 82°22'E, elev. 15 m, 15.viii.1990, on *C. stricta* (basal squamules, podetia), *M.P. Zhurbenko 901085a* (LE 308571a); Taimyr Peninsula, Levinson-Lessinga Lake, 74°31'N, 98°27'E, elev. 450 m, 10.viii.1995, on *C. stygia* (podetia), *M.P. Zhurbenko 95597* (LE 308908); 74°31'N, 98°36'E, elev. 200 m, 26.viii.1995, on *C. pyxidata* (basal squamules, podetia), *M.P. Zhurbenko 95600b* (LE 308920b); Western Sayan Mts., headwaters of Sinyaya River, elev. 2350 m, 22.viii.1991, on *Cladonia* sp. (basal squamules), *V.B. Kuvaev s.n.* (LE 308861); Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°30'E, elev. 1500 m, on *C. pocillum* (basal squamules, podetia), 14.vii.2009, *M.P. Zhurbenko 0954* (LE 308656); 22.vii.2009, *M.P. Zhurbenko 0964* (LE 308665); 24.vii.2009, *M.P. Zhurbenko 0974a* (LE 308674a). **REPUBLIC OF BURYATIA:** Khamar-Daban Range, headwaters of Klyuchevaya River, 2.viii.1996, on *C. coccifera* (basal squamules), *I.N. Urbanavichene s.n.* (LE 308832). **TRANS-BAIKAL TERRITORY:** Kodar Range, Leprindinskoe Plateau, 56°40'00"N, 117°24'52"E, elev. 2042 m, 15.viii.2012, on *Cladonia* sp. (basal squamules), *L.A. Konoreva s.n.* (LE 309236). **U.S.A. ALASKA:** Prudhoe Bay, 1989, on *C. pocillum* (basal squamules), *C. Parker s.n.* (LE 309148).

Pyrenidium actinellum **Nyl. s. lat.**

DESCRIPTION. – *Ascomata* 160–230 µm in diameter, subimmersed to almost sessile, sometimes aggregated on stromatic gall-like swellings up to 2 mm diameter; wall brown, K+ olive; blue-green/green pigmentation usually present near the ostiole. *Asci* 4(–5) spored. *Ascospores* ellipsoid, light to dark brown, end cells sometimes paler, (19.0–)21.3–25.7(–28.0) × (8.5–)9.2–10.8(–11.5) µm, l/b = (1.8–)2.1–2.7(–3.2) (n = 34, in water or K), (1–)3-septate, constricted at the septa.

NOTES. – This taxon was found on the podetia of *Cladonia arbuscula* s. lat., *C. squamosa* and an unidentified *Cladonia* species. It was often associated with moribund parts of the host thallus, and sometimes induced gall-like swellings. This is the first report of *Pyrenidium actinellum*, albeit in a broad sense, from Vietnam. The species has been reported on various lichen host genera that are not closely related and these are the first reports from *Cladonia*.

Specimens examined. – **PORTUGAL. AZORES ISLANDS:** Faial Island, Caldeira, 38°34'28"N, 28°41'48"W, elev. 730 m, 25.ii.2015, on *Cladonia squamosa* (blackened areas of podetia), *R. Pino-Bodas s.n.* (H). **VIETNAM. DAK LAK PROVINCE:** Chu Yang Sin National Park, 8 km W of Mt. Chu Yang Sin, 12°22'16"N, 108°21'13"E, elev. 1900 m, montane tropical forest, 23.iii.2013, on *Cladonia* sp. (podetia) growing on rock, *A.V. Alexandrova s.n.* (LE 261147). **U.S.A. ALASKA:** Tanana River, Bonanza Creek, 64°51'N, 147°49'W, elev. 130 m, 22.viii.2004, on *C. arbuscula* (over the entire length of podetia, mainly on their moribund bases), *M.P. Zhurbenko 04258* (LE 308511); Goldstream Valley, 64°57.155'N, 147°42.832'W, 12.viii.2004, on *C. arbuscula* (moribund parts of podetia), *M.P. Zhurbenko 04135a* (LE 309144a).

Roselliniella cladoniae **(Anzi) Matzer & Hafellner**

DESCRIPTION. – *Ascomata* pyriform, 250–500 µm in diameter, superficial, basally or sometimes laterally attached to the host, covered by medium brown, remotely septate, long hyphae, protruding or descending to the host thallus surface. *Ascospores* initially hyaline, then medium brown, mainly ellipsoid, occasionally narrowly ellipsoid, oblong, ovoid, citriform or subglobose, apices rather acute to occasionally rounded, sometimes attenuated or with a small beak/apiculus, aseptate or occasionally with 1 (non-median) to exceptionally up to 4 thin septa, not constricted at the septa, (11.8–)18.2–29.0(–38.0) × (7.3–)9.8–13.2(–16.5) µm, l/b = (1.3–)1.7–2.5(–4.0) (n = 182), significantly varying in size in different specimens, usually with few large and numerous small guttules, wall smooth and thin, sometimes cracking and disintegrating into large pieces in squash mounts, occasionally with halo when immature, 4–8 per ascus, mostly diagonally uniseriate or partly biseriate in the asci.

NOTES. – A characteristic hyphomycete (Figure 10) possibly representing the anamorph of this species is sometimes associated with the ascomata. According to Matzer & Hafellner (1990), the ascospores of this taxon are mostly verruculose, (1–)2–8 per ascus, and longer (15–52 × 6–17 µm) than those reported here. We found the species on the podetia and/or basal squamules of *Cladonia arbuscula*, *C. ceratophyllina*, *C. coccifera*, *C. coniocraea*, *C. corniculata*, *C. cornuta*, *C. crispata*, *C. didyma*, *C. fimbriata*, *C. gracilis* s. lat., *C. gracilis* ssp. *turbinata*, *C. gracilis* ssp. *vulnerata*, *C. mitis*, *C. pocillum*, *C. pyxidata*, *C. rangiferina*, *C. subfurcata*, *C. sulphurina*, *C. symphycarpa*, *C. trassii* and unidentified *Cladon-*

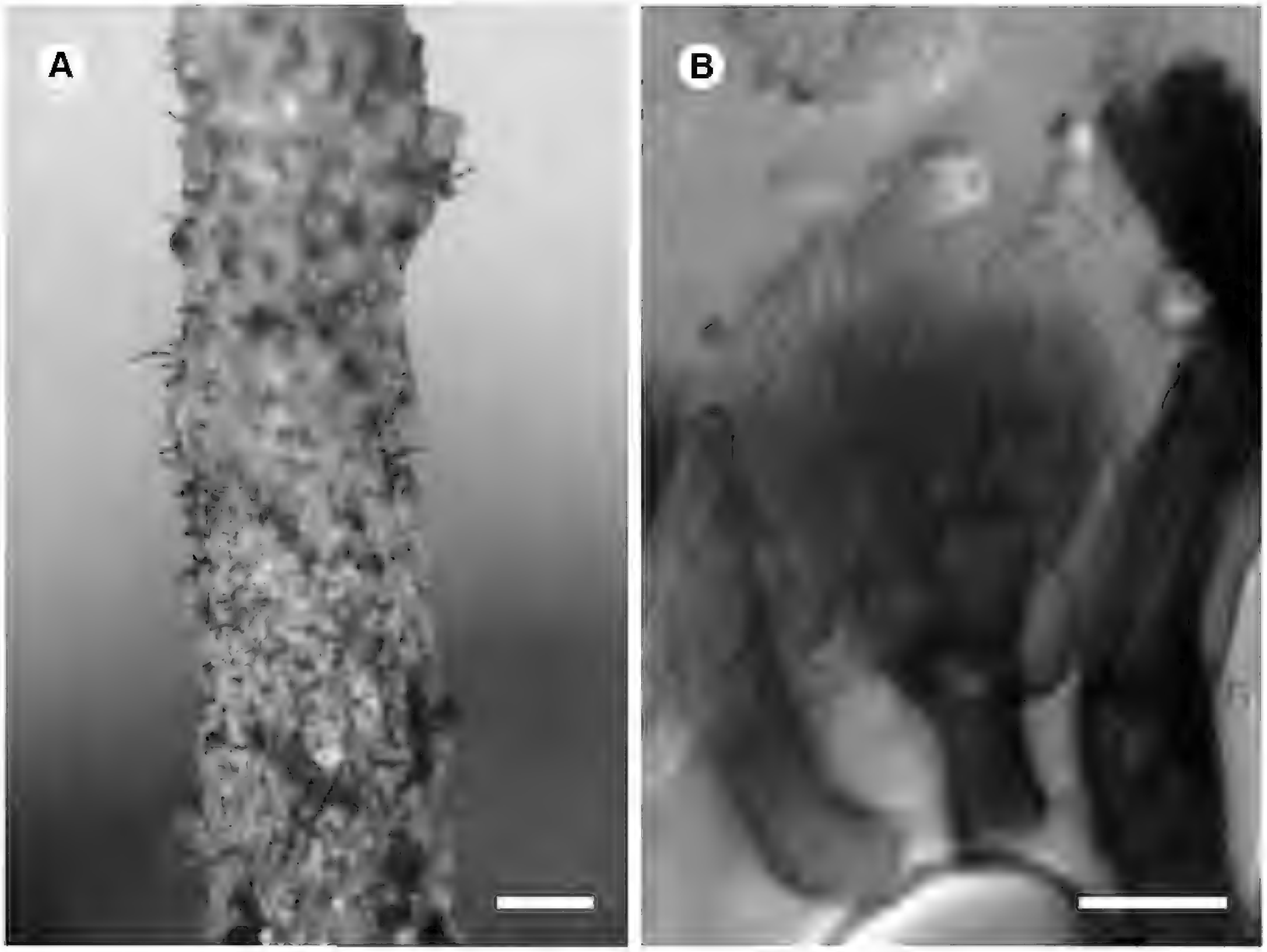

Figure 10. A hyphomycete associated with *Roselliniella cladoniae*. **A,** colonies (LE 308649a). **B,** conidiogenous head at the top of conidiophore in K (LE 308853). Scale bars: A = 200 µm, B = 10 µm.

-*ia* species. Pathogenicity was not observed. The species is widely distributed in the Holarctic including the tundra biome, but is not known from the polar desert biome. Here we report it for the first time from Finland and Venezuela. Previously it was known in Africa only from Macaronesia (Berger & Aptroot 2002, Hafellner 1996). *Cladonia ceratophyllina*, *C. corniculata*, *C. didyma*, *C. fimbriata*, *C. subfurcata*, *C. symphycarpa* and *C. trassii* are new host species.

Specimens examined. – **CZECH REPUBLIC. SOUTH BOHEMIA:** 2 km W of Dráchov, 49°13'40"N, 14°40'04"E, elev. 440 m, 31.viii.2014, on *Cladonia rangiferina* (thallus), *J. Kocourková s.n.* (H). **FINLAND. SOUTH HÄME:** Kaivolampi, 61°06'01"N, 24°12'06"E, elev. 130 m, 18.iv.2008, on *C. gracilis* ssp. *turbinata* (podetia), *H. Väre 1863a* (H). **PÄIJÄNNE TAVASTIA:** Paistjärvi, Kärmevuori, 61°16'N, 26°21'E, 8.x.2009, on *C. mitis* (podetia), *V. Haikonen 27415a* (H). **UUSIMAA:** Sipoo, S of Sipoonkorven National Park, 60°16'12"N, 25°09'00"E, 13.xi.2014, on *C. arbuscula* (podetia), *R. Pino-Bodas s.n.* (H, with presumed anamorph); Espoo, Luukkaa Recreation Area, 60°19'N, 24°39'E, elev. 90 m, 19.ix.2014, on *C. arbuscula* (podetia), *R. Pino-Bodas s.n.* (H); Uusimaa, Helsinki, Kontula, 60°24'35"N, 25°04'07"E, 10.viii.2014, on *C. mitis* (podetia), *R. Pino-Bodas s.n.* (H). **RUSSIA. MURMANSK REGION:** Khibiny Mts., Mt. Kukisvumchorr, 67°40'N, 33°41'E, elev. 500 m, 15.viii.1997, on *C. trassii* (underside of basal squamules), *M.P. Zhurbenko 97419* (LE 308923, with presumed anamorph). **KRASNOYARSK TERRITORY:** Taimyr Peninsula, Enisey Bay, Sibiryakova Island, 72°50'N, 79°10'E, 8.vii.1989, on *C. subfurcata* (podetia), *A. Kozhevnikova s.n.* (LE 309175, with presumed anamorph); Western Sayan Mts., Ergaki Nature Park, Tushkanchik River, 52°47'N, 93°21'E, elev. 1150 m, 23.vii.2010, on *C. sulphurina* (podetia), *M.P. Zhurbenko 1039* (LE 308677). **REPUBLIC OF BURYATIA:** Khamar-Daban Range, Bol'shoi Mamai River, 29.vi.1965, on *C. gracilis* (podetia), *L.G. Burova s.n.* (LE 308853, with presumed anamorph); Dzherginskii Reserve, Dzhirga River, 54°54'14"N, 111°16'27"E, 19.vii.2002, on *Cladonia* sp. (podetia), *T.M. Kharpukhaeva s.n.* (LE 309105b). **KHABAROVSK TERRITORY:**

Bol'shekhekhtsirskii Reserve, Sosnenskii Creek, 48°14'50"N, 134°46'46"E, elev. 340 m, 2.viii.2013, on *C. coniocraea* (podetia, basal squamules), *M.P. Zhurbenko 13157* (LE 308633), 4.viii.2013, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 13156* (LE 308632). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Dal'negorsk, 44°35'48"N, 135°33'12"E, elev. 240 m, 18.viii.2013, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 13158* (LE 308634); Sikhote-Alin' Range, 2 km N of confluence of Yasnaya and Zabolochennaya Rivers, 45°15'13"N, 136°30'10"E, elev. 180 m, 27.viii.2013, on *C. pyxidata* (podetia), *M.P. Zhurbenko 13166* (LE 308644); Sikhote-Alin' Range, Kabanii Creek, 45°06'35"N, 135°52'01"E, elev. 490 m, 5.ix.2013, on *C. coniocraea* (basal squamules, podetia), *M.P. Zhurbenko 13167a* (LE 308649a, with presumed anamorph), *M.P. Zhurbenko 13148* (LE 308639); Sikhote-Alin' Range, Iman River, 3 km W of Glubinnoe, 46°04'N, 135°23'E, 31.viii.1946, on *C. gracilis* (podetia), *M.V. Korchaginy & A.A. Korchaginy s.n.* (LE 308768a). **KAMCHATKA TERRITORY:** Kamchatka Peninsula, Kronotsky Nature Reserve, Levaya Schapina River, 55°08'38"N, 159°59'24"E, elev. 370 m, 13.viii.2009, on *Cladonia* sp. (moribund podetia), *D.E. Himelbrant & I.S. Stepanchikova s.n.* (LE 308520b). **MONGOLIA. ARA-KHANGAI AIMAK:** watershed of Khukh-Sumein-Gol and Tsetserleg-Gol Rivers, Mt. Khairkhan, 47°15'N, 101°50'E, elev. 2200 m, 28.viii.1979, on *C. cornuta* (darkened bases of podetia), *L.G. Biazrov 3328* (LE 308563). **U.S.A. ALASKA:** Seward Peninsula, Quartz Creek, 65.4279°N, 164.614°W, 24.vii.2012, on *C. coccifera* (podetia, basal squamules), *A. Breen 2012129* (LE 308508); Gates of the Arctic National Park and Preserve, 67.3213°N, 53.4694°W, elev. 1 m, 7.viii.2008, on *C. pocillum* (bleached basal squamules), *T. Loomis s.n.* (LE 308565a); Kotzebue, 1961, on *C. coccifera* (basal squamules), *B. Neiland* (LE 309116); 66°53'N, 162°31'W, elev. 30 m, 19.viii.2000, on *C. gracilis* ssp. *vulnerata* (podetia), *M.P. Zhurbenko 00213* (LE 308562), *M.P. Zhurbenko 00233c* (LE 309122, with presumed anamorph), *M.P. Zhurbenko 00243b* (LE 308592b); Great Kobuk Sand Dunes, 67°06'N, 159°02'W, elev. 40 m, 4.viii.2000, on *C. symphycarpa* (underside of basal squamules), *M.P. Zhurbenko 00119b* (LE 309041b); 8.viii.2000, *M.P. Zhurbenko 00472* (LE 308480); 9.viii.2000, on *C. gracilis* (podetia), *M.P. Zhurbenko 00104* (LE 309123), *M.P. Zhurbenko 00180a* (LE 308507a, with presumed anamorph); on *C. rangiferina* (podetia), *M.P. Zhurbenko 00249* (LE 309119, with presumed anamorph); Goldstream Valley, 64°57'N, 147°43'W, 31.vii.2004, on *C. cornuta* (podetia), *M.P. Zhurbenko 0464* (LE 309120, with presumed anamorph), *M.P. Zhurbenko 0469* (LE 309128); on *C. crispata* (podetia), *M.P. Zhurbenko 0462* (LE 309130, with presumed anamorph); Fairbanks, 64°52'N, 147°52'W, elev. 170 m, 14.viii.2004, on *C. cornuta* (podetia), *M.P. Zhurbenko 04154a* (LE 309127a); on *C. arbuscula* (podetia), *M.P. Zhurbenko 04145* (LE 309124, with presumed anamorph); 64°54'N, 147°49'W, 15.viii.2004, on *C. gracilis* (podetia), *M.P. Zhurbenko 04160* (LE 309121); Tanana River, Bonanza Creek, 64°51'N, 147°49'W, elev. 150 m, 21.viii.2004, on *C. fimbriata* (podetia), *M.P. Zhurbenko 04260* (LE 309129, with presumed anamorph); on *C. gracilis* (podetia), *M.P. Zhurbenko 04267* (LE 309126), 25.viii.2004; on *C. cornuta* (podetia), *M.P. Zhurbenko 04275a* (LE 309125a); on *C. pocillum* (basal squamules), *M.P. Zhurbenko 04279* (LE 309131). **FRANCE (OVERSEAS DEPARTMENT). RÉUNION:** NE of Bourg-Murat, Col de Bellevue, 21.1780°S, 55.5801°E, elev. 1617 m, 9.ix.2009, on *C. ceratophyllina* (podetia), *F. Schumm & J.-P. Frahm 15184 s.n.* (H). **VENEZUELA. MÉRIDA:** Páramo de Guaraque vía Tovar-Guaraque, 8°10'N, 71°46'W, elev. 2400 m, 31.iii.1980, on *C. didyma* (podetia), *M. López Figueiras 22747a* (H). **NEW ZEALAND. SOUTH ISLAND:** Wilderness Scientific Reserve, 45.532°S, 167.856°E, 6.v.2010, on *C. corniculata* (podetia), *S. Stenroos 5769a* (H).

***Sclerococcum crassitunicatum* Zhurb., Diederich & U. Braun, sp. nov.**
MycoBank #MB 819559

FIGURE 11

DIAGNOSIS. – Lichenicolous fungus. Morphologically similar to *Sclerococcum aptrootii*, but distinguished by having persistently aseptate and larger conidia, 7.5–9.5 × 6.5–8 µm (vs. 5–6.5 × 4–5 µm in *S. aptrootii*), with a much thicker wall up to 2 µm wide, never forming distinct chains, and a different host, *Cladonia* vs. *Fissurina*.

TYPE: **U.S.A. ALASKA:** Skyline Ridge, 10 km N of Fairbanks, 64°55.270' N, 147°43.001' W, elev. 470 m, *Picea mariana* forest, 31.vii.2004, on thalli and apothecia of *Cladonia gracilis*, *M.P. Zhurbenko 0450a* (LE 309173!, holotype; herb. Diederich!, isotype).

DESCRIPTION. – *Vegetative hyphae* pale brown, immersed in the host thallus. *Conidiomata*

sporodochioid, dark brown to blackish, usually more or less pulvinate or occasionally flattened to host thallus level, (40–)60–120(–180) µm in diameter (n = 59) and up to 90 µm tall, usually originating from cupuliform depressions of the host thallus 40–130 µm in diameter, 20–80 µm deep; distinct conidiomatal wall not developed, but surrounding host tissues forming a pale to medium brown layer 10–20(–40) µm thick; dispersed to occasionally gregarious. *Conidiophores* little differentiated, micronematous, arising from supporting hypha of tightly adhering compact 'parenchymatous' sporodochioid hyphal aggregations, few-celled or reduced to conidiogenous cells measuring (4.6–)5.4–7.6(–9.5) × (3.3–)4.0–6.0(–7.8) µm (n = 20), differentiation beween hyphae and conidiophores difficult to distinguish. *Conidia* formed from hyaline, thick-walled conidiogenous cells integrated in a 'parenchymatous' cell mass presumably by budding; under maturation becoming light to medium olive gray (olive brown in K), mostly subglobose, sometimes broadly ellipsoid, ovoid, oblong with truncate ends, triangular, quadrangular, pentangular in surface view or irregularly shaped, rarely with an apiculus-like projection, (6.0–)7.4–9.6(–12.8) × (4.3–)6.5–8.1(–9.6) µm, l/b = (1.0–)1.1–1.3(–1.7) (n = 153), aseptate, formed singly, neither in distinct chains nor in groups, with smooth or at least sometimes minutely verruculose (× 1000, DIC), 1.2–2.0 µm thick wall (thus reminiscent of chlamydosporous conidia), usually composed of two distinct layers visible in light microscopy, sometimes with large guttules clearly seen in K, glued together in cirrhus-like aggregations on the host surface.

ETYMOLOGY. – The epithet refers to the remarkably thick-walled conidia of the fungus.

DISTRIBUTION AND HOSTS. – The new species is known only from the type collection that was made in the boreal forest (taiga) biome of North America (Alaska), growing on thalli and apothecia of *Cladonia gracilis* and *C. cornuta*. Pathogenicity was not observed.

DISCUSSION. – The conidiogenesis of *Sclerococcum* Fr. species is considered to be mono- to polyblastic or possibly "meristem thallic" (Seifert et al. 2011). Without cultures, it is difficult to discern details of the conidiogenesis of the new cladoniicolous species. However, the conidiogenous cells presumably give rise to conidia by budding, which is supported by the observation of presumed conidiogenous cells with small neck-like projections suggesting conidial formation by cell budding. Hence, the conidiogenesis of the new species on *Cladonia* coincides with the principle processes of conidial formation of species assigned to *Sclerococcum* and can be assigned to this genus in its current circumscription, irrespective of whether the genus is monophyletic or polyphyletic.

Due to the aseptate, smooth-walled conidia, the new species is similar to *Sclerococcum simplex* D. Hawksw. (confined to corticolous *Pertusaria* species) and *S. aptrootii* Diederich (growing on *Fissurina* species). However, these two species are readily distinguished by their indistinctly catenate, medium to dark brown, smaller conidia [(3.5–)4–7(–8) µm in diameter and (4.5–)5.0–6.3(–7.2) × (4.0–)4.1–5.0(–5.7) µm, respectively] with thinner walls, occasionally provided with a single septum, and in occurring on different hosts (Diederich 2015, Hawksworth 1979). Additionally, *S. simplex* differs in having larger, often confluent sporodochia [(50–)100–300 µm in diameter]. *Sclerococcum epicladonia*, also described from *Cladonia* in this contribution, is quite distinct because of its brown, multi-celled, comparatively thin-walled conidia. *Cladophialophora cladoniae* (syn. *Sclerococcum cladoniae* Diederich) develops similar, minuscule conidiomata on the thallus of *Cladonia* species, but is distinguished by its much smaller, thin-walled, indistinctly catenate conidia that are 2.2–3 µm in diameter (Diederich 2010, Diederich et al. 2013).

The new species also recalls the lichenicolous genera *Caeruleoconidia*, *Coniambigua*, *Epaphroconidia*, *Katherinomyces* Khodos. and *Nigropuncta* D. Hawksw. Comparison with their type species reveals the following differences. *Caeruleoconidia ochrolechiae* occurs on *Ochrolechia* species and differs in having conidiomata with a lateral ring-like rudimentary wall and greenish blue, 0(–1)-septate, smooth-walled conidia (Zhurbenko et al. 2015a). *Coniambigua phaeographidis* Etayo & Diederich is confined to *Phaeographis* species and strongly resembles *S. crassitunicatum*. While its conidiogenesis is difficult to interpret, the distinct conidiophores observed in the new species are not present in that taxon (Etayo & Diederich 1995). *Epaphroconidia hawksworthii* Calatayud & V. Atienza occurs on species of *Pertusaria* and is distinguished from the new species by its pycnidial conidiomata with bluish green walls, enteroblastic conidiogenesis, and much larger, hyaline conidia (Calatayud & Atienza 1995). *Katherinomyces cetrariae* Khodos., recently described from *Cetraria aculeata*, is distinct by its pycnidium-like conidiomata, poorly developed conidiophores, consisting of 1–2 cells, and brown conidia, sometimes forming short chains (Khodosovtsev et al. 2016). *Nigropuncta rugulosa* D. Hawksw. confined to species of

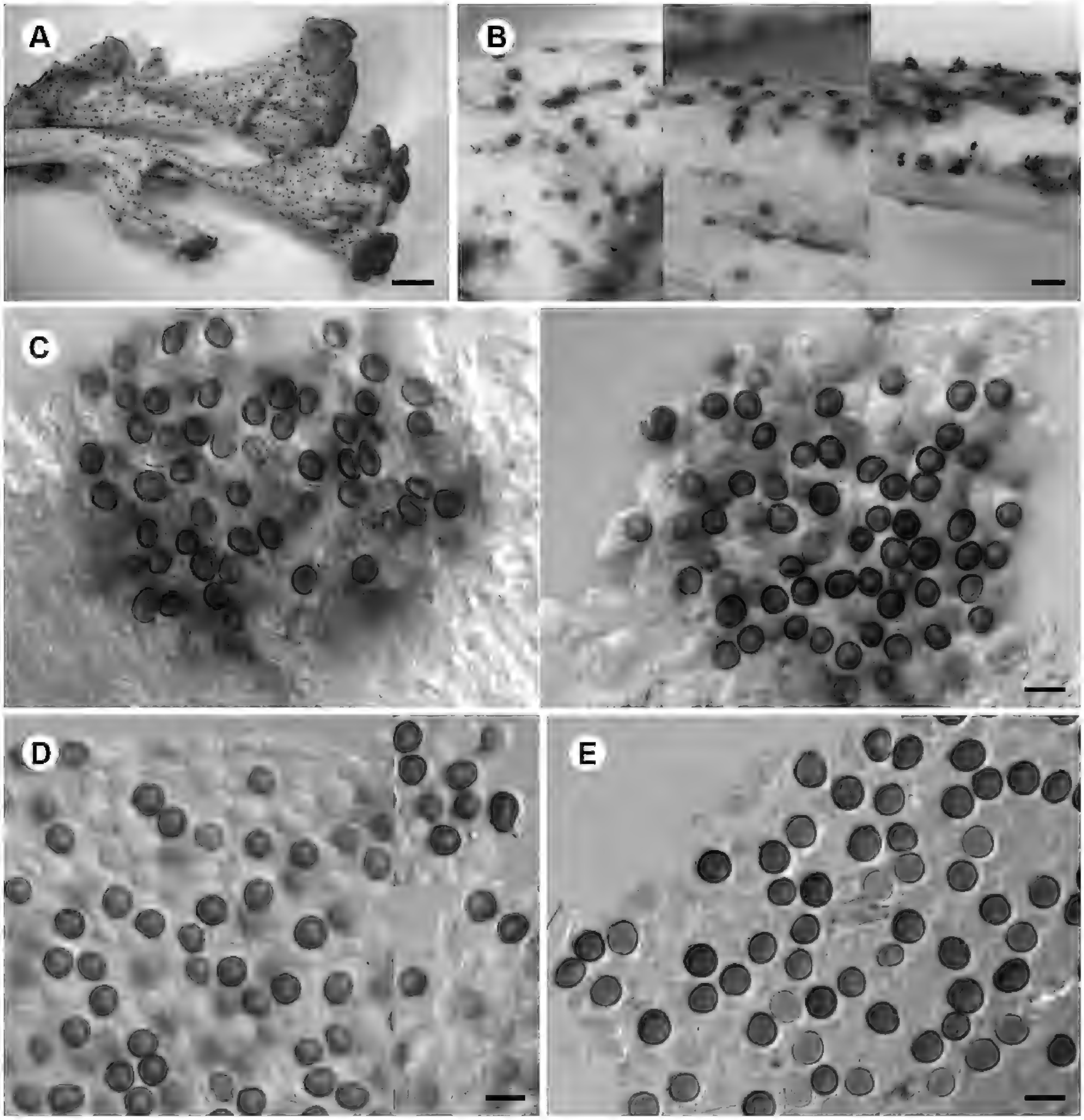

Figure 11. *Sclerococcum crassitunicatum* (all from the holotype). **A & B,** infections on the host surface. **C,** conidiomata in cross section in water. **D,** conidiomata in cross section in K; note presumabe budding of the conidia and a conidium with an apiculus-like projection. **E,** conidiomata in cross section in Phloxine B after 10% KOH pre-treatment. Scale bars: A = 2 mm, B = 200 µm, C–E = 10 µm.

Bellemerea resembles the new species in such characters as having a blackish cirrhus, an indistinct conidiomatal wall and thick-walled conidia of a similar color, but clearly differs in having pycnidial conidiomata, a distinctly thallic conidiogenesis and conidia that are mainly 1–2-celled or sometimes multi-celled, with a granular-lacerate wall, arising in short chains (Hawksworth 1981).

Additional specimen examined. – Same locality as type, on *Cladonia cornuta* (podetia), *M.P. Zhurbenko 0450b* (LE 309453, paratype).

Sclerococcum epicladonia **Zhurb., sp. nov.**
MycoBank #MB 819560

FIGURE 12

DIAGNOSIS. – Lichenicolous fungus. Morphologically similar to *Sclerococcum sphaerale*, but distinguished mainly by the loose versus compact sporodochia, the approximately 2–50-celled rather than 2–9-celled conidia that are longer (up to 30 µm long), and occurrence on *Cladonia* rather than *Pertusaria*.

TYPE: **RUSSIA. KRASNODAR TERRITORY:** Caucasus, Mt. Armovka, 43°54'18"N, 40°39'43"E, elev. 1700 m, mixed forest, 1.ix.2014, on *Cladonia chlorophaea* (podetia), *M.P. Zhurbenko 14481a* (LE 309449a!, holotype).

DESCRIPTION. – *Vegetative hyphae* hyaline to light brown, ca. 1.5–2.5 µm wide, septate, occasionally branched, immersed in the host thallus. *Colonies* dark brown to mostly almost black, aggregated in dispersed to contiguous, loose, superficial sporodochia (20–)43–145(–260) µm in diameter (n = 42). *Conidiophores* hyaline to light brown, semi-macronematous, formed by a chain of single or occasionally double, subglobose or elongated cells, constricted at the septa, 2.2–4(–6.5) µm in diameter, not or occasionally branched. *Conidiogenous cells* subhyaline to light brown, monoblastic or occasionally polyblastic, integrated, terminal, determinate, more or less doliiform, often somewhat tapering downwards, (2.7–)3.3–4.9(–5.8) × (2.6–)2.8–4.0(–4.4) µm (n = 14, in K), not very distinct. *Conidia* light to mainly medium brown, K+ olive, dry, acrogenous, irregularly subglobose to irregularly elongated, sometimes indistinctly lobed, composed of two to ca. 50 cells (single cells also rarely observed in squash mounts), with individual cells (3.4–)3.6–4.8(–5.7) × (2.1–)2.7–3.9(–4.4) µm (n = 32), in total (5.4–)7.2–18.4(–30.0) × (3.4–)5.7–13.7(–23.5) µm, l/b = 1.0–1.6(–2.3) (n = 159, in water or K), sizes depending on the number of cells, as presented in Table 1, the largest conidia disintegrating in squash preparations in K into fragments, occasionally in short chains when few-celled, with evenly thickened and evenly colored smooth wall ca. 0.5–0.8 µm thick, not splitting at maturation.

ETYMOLOGY. – The epithet refers to the host lichen genus *Cladonia*.

DISTRIBUTION AND HOSTS. – The new species is known from two specimens collected in mountain forests of Asia (the Caucasus and Sayan Mountains), where it grew on the podetia and basal squamules of *Cladonia chlorophaea* and *C. coniocraea*. Distinct pathogenicity was not observed.

DISCUSSION. – At present the genus *Sclerococcum* includes 13 species of lichenicolous fungi confined to particular host genera, none of which is known to grow on *Cladonia* (Lawrey & Diederich 2016). Among those species only *S. epiphytorum* Diederich (which occurs on *Varicellaria hemisphaerica*), *S. serusiauxii* Boqueras & Diederich (which occurs on *Parmelina* spp.) and *S. sphaerale* (Ach.) Fr. (the generic type, which occurs on *Pertusaria* spp.) are also characterized by smooth-walled multi-celled conidia like those of the new species (Diederich 2015). *Sclerococcum epiphytorum* is distinguished from *S. epicladonia* by its smaller (9–15 × 6–10 µm), 2–7-celled, sometimes finely verruculose conidia (Diederich 1990). *Sclerococcum serusiauxii* differs in having conidia with unevenly thickened walls and well-delimited darker regions (Boqueras & Diederich 1993). Finally *S. sphaerale* differs in having 2–6(–9)-celled, smaller conidia [(8–)10–15(–17) µm in length], with larger individual cells [mainly (4–)6–10 µm in diameter] (Hawksworth 1975a). Additionally, the aforementioned species can be distinguished from *S. epicladonia* by their compact sporodochia and different host selection. *Sclerococcum crassitunicatum*, the other species of the genus growing on *Cladonia* that is also described here, is readily distinguishable from *S. epicladonia* by its olive gray, aseptate, thick-walled conidia. *Sclerococcum epicladonia* is also reminiscent of lichenicolous species of *Cladophialophora* Borelli, including *C. cladoniae* that occurs on *Cladonia*. Members of the genus have quite loose sporodochia as well, but clearly differ from the new species in having aseptate or 1-septate, sometimes ornamented conidia (Diederich et al. 2013).

Additional specimen examined. – **RUSSIA. REPUBLIC OF BURYATIA:** Eastern Sayan, Tunka Mts., near Arshan, Kyngarga River valley, 51°56'N, 102°25'E, elev. 900 m, taiga forest, 11.vi.2005, on *Cladonia coniocraea* (basal squamules, mainly underside), *M.P. Zhurbenko 0525* (LE 309451).

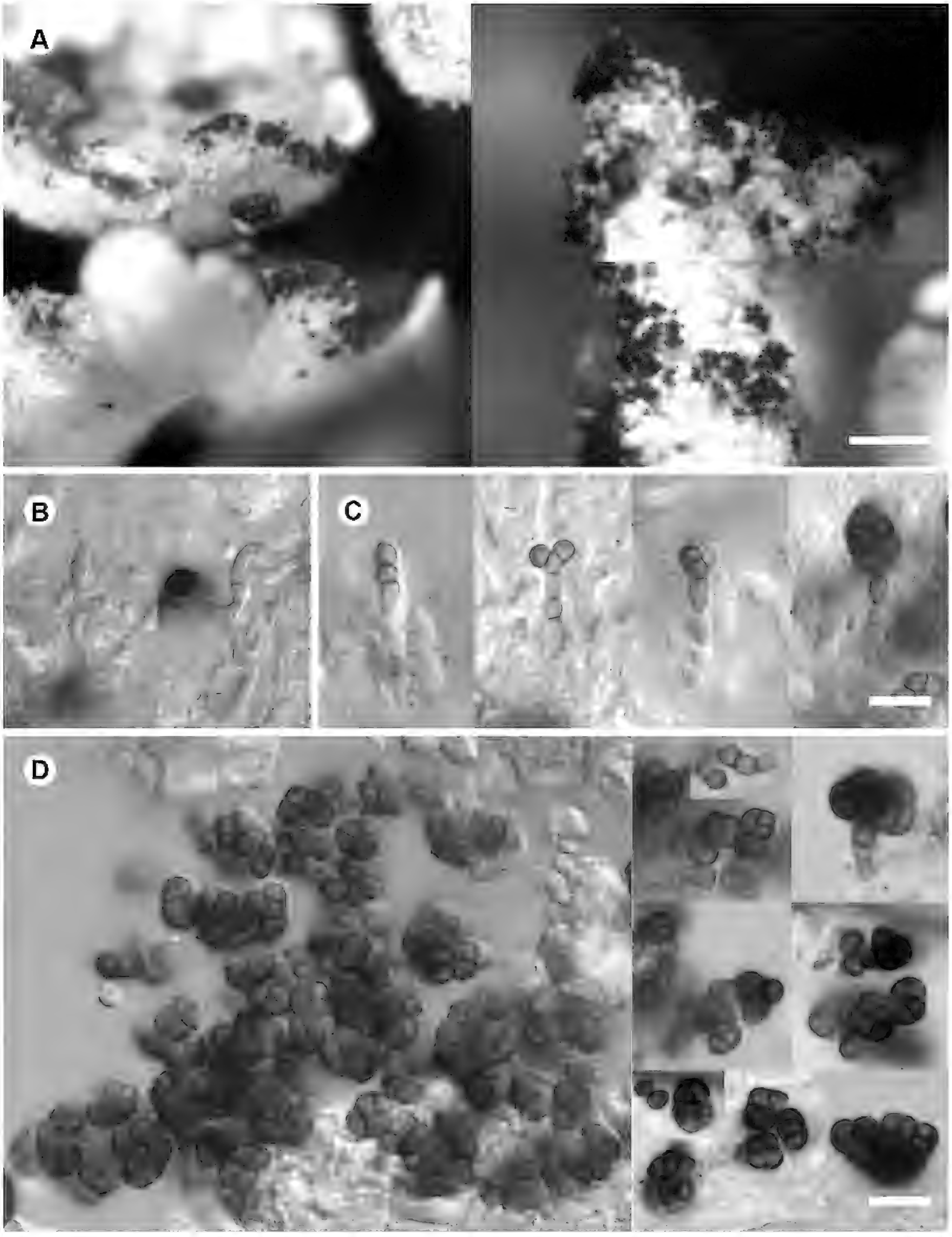

Figure 12. *Sclerococcum epicladonia*. **A,** colonies (left, LE 309451; right, holotype). **B,** vegetative hyphae in K (LE 309451). **C,** conidiophores and conidiogenous cells with conidia in K (LE 309451). **D,** conidia in water (left, LE 309451) and in K (right, holotype). Scale bars: A = 200 µm, B–D = 10 µm.

Cells per conidium	Length (µm)	Breadth (µm)	Length/ breadth ratio	Measurements (in water or K)
2	(5.4–)5.9–7.3(–8.1)	(3.4–)3.7–5.3(–6.5)	(1.2–)1.3–1.7(–2.0)	14
3–5	(5.6–)6.3–8.7(–11.0)	(4.4–)5.2–7.0(–8.1)	1.0–1.4(–1.6)	31
6–10	(8.0–)9.3–13.1(–15.0)	(6.0–)7.3–10.7(–12.2)	1.0–1.6(–2.1)	32
11–15	(12.1–)12.4–16.2(–18.2)	(9.2–)10.0–12.8(–14.0)	1.1–1.5(–1.6)	17
16–~50	(16.0–)17.7–24.9(–30.0)	(10.7–)13.1–19.1(–23.5)	(1.0–)1.1–1.5(–1.9)	25

Table 1. Sizes of conidia of *Sclerococcum epicladonia* depending on the number of cells per conidium.

***Sphaerellothecium cladoniae* (Alstrup & Zhurb.) Hafellner**

NOTES. – This species was found on the basal squamules, and rarely podetia, of *Cladonia* cf. *cariosa*, *C. coccifera*, *C. ochrochlora*, *C. pocillum* (most occurrences), *C. pyxidata* and unidentified *Cladonia* species. The infected parts of the host were sometimes bleached. It is widely distributed in the Holarctic including the polar desert biome (Zhurbenko & Alstrup 2004). This is the first report from Kazakhstan and *C. ochrochlora* is a new host species.

Specimens examined. – **NORWAY. TROMS COUNTY:** Skibotndalen Valley, 69º19.6'N, 20º21.2'E, elev. 50 m, 6.viii.2003, on *Cladonia pocillum* (basal squamules), *M.P. Zhurbenko 036* (LE 309158). **RUSSIA. MURMANSK REGION:** Barents Sea coast, Olenka River mouth, 69°02'N, 36°24'E, elev. 50 m, 5.ix.1997, on *C. coccifera* (basal squamules), *M.P. Zhurbenko 97418* (LE 308921). **REPUBLIC OF ADYGEYA:** Caucasus, Mt. Tybga, 43°52'48" N, 40°15'59" E, elev. 2480 m, 5.viii.2014, on *C. coccifera* (basal squamules), *M.P. Zhurbenko 14435* (LE 309443); Mt. Ekspeditsiya, 43°55'N, 40°16'E, elev. 2000 m, 9.viii.2014, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 14291* (LE 308625), 6.viii.2014, on *C. pocillum* (basal squamules), *A.A. Kobzeva 1486* (LE 308628). **KRASNODAR TERRITORY:** Caucasus, Mt. Armovka, 43°52'28"N, 40°39'20"E, elev. 2250 m, 31.viii.2014, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 14293* (LE 308627); 30.viii.2014, on *C. pyxidata* (basal squamules), *M.P. Zhurbenko 14292* (LE 308626); Lagonaki Upland, Mt. Fisht, 43°57'08"N, 39°55'42"E, elev. 1640 m, 19.viii.2014, on *Cladonia* sp. (basal squamules), *A.A. Kobzeva 1482* (LE 308629); on *C. pocillum* (basal squamules), *A.A. Kobzeva 1479* (LE 308630); between Mt. Fisht and Mt. Pshekho-Su, 43°58'36"N, 39°53'38"E, elev. 2050 m, 21.viii.2014, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 14403* (LE 309444); on *C. pocillum* (basal squamules, occasionally podetia), *M.P. Zhurbenko 14402* (LE 309445). **KRASNOYARSK TERRITORY:** Taimyr Peninsula, Aya-Turku Lake, 73°50'N, 92°10'E, on *C. pocillum* (basal squamules), 14.viii.1975, *M.V. Sokolova s.n.* (LE 308696); Putorana Plateau, Kapchuk Lake, 69º29'N, 91º00'E, elev. 1000 m, 13.viii.1983, on *C. pyxidata* (basal squamules), *M.P. Zhurbenko 83161c* (LE 207221c); on *C.* cf. *cariosa* (basal squamules), *M.P. Zhurbenko 83162* (LE 207220); Western Sayan Mts., Ergaki Nature Park, Bol'shaya Baklanikha River, 52°46'N, 93°19'E, elev. 1150 m, 24.vii.2010, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 1048* (LE 308683); Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°31'E, elev. 1500 m, 4.vii.2009, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 0943* (LE 308650); 14.vii.2009, *M.P. Zhurbenko 0957* (LE 308659); 20.vii.2009, *M.P. Zhurbenko 0963* (LE 308664); 22.vii.2009, *M.P. Zhurbenko 0966a* (LE 308667a); 24.vii.2009, *M.P. Zhurbenko 0974c* (LE 308674c). **REPUBLIC OF ALTAI:** Ukok Tableland, ca. 49°18'N, 87°36'E, elev. 2400 m, 6.viii.1996, on *C. coccifera* (basal squamules), *T. Lunke 532* (LE 308889). **REPUBLIC OF BURYATIA:** Tunka Mts., Arshan, 51º56'N, 102º25'E, elev. 1080 m, 11.vi.2005, on *C. pocillum* (basal squamules, partly bleached), *M.P. Zhurbenko 0518* (LE 309156). **TRANS-BAIKAL TERRITORY:** Kodar Range, Sul'ban River, 56°50'12"N, 117°17'21"E, elev. 1655 m, 14.vi.2015, on *C.* cf. *pyxidata* (basal squamules), *S.V. Chesnokov s.n.* (LE 309231). **REPUBLIC OF SAKHA (YAKUTIA):** Tiksi, 71°37'N, 128°54'E, elev. 70 m, 18.vii.1998, on *Cladonia* sp. (moribund basal squamules), *M.P. Zhurbenko 98416b* (LE 308912b); confluence of Indigirka and In'yali Rivers, 65°10'N, 143°10'E, 16.vi.1976, on *C. pyxidata* (basal squamules), *I.I. Makarova s.n.* (LE 308887). **KAZAKHSTAN.** Central Tyan'-Shan' Mts., Turgen'-Aksu River, 25.vii.1979, on *C. pocillum* (basal squamules), *L.I. Bredkina 2831* (LE 308858); Central Tyan'-Shan' Mts., Kuilyu River, 27.vii.1979, on *C. pocillum* (basal squamules), *L.I. Bredkina 2926* (LE 308852). **MONGOLIA. ARA-KHANGAI AIMAK:** watershed of Khukh-Sumein-Gol and Tsetserleg-Gol Rivers, Mt. Khairkhan, 47º15'N, 101º50'E, elev. 2000 m, 1.viii.1979, on *C. ochrochlora* (basal squamules), *L.G. Biazrov 3555* (LE 308859). **U.S.A. ALASKA:** Gates of the Arctic National Park and Preserve, 67.3213°N, 53.4694°W, 7.viii.2008, on *C. pocillum* (basal squamules), *T. Loomis s.n.* (LE 308565b); Denali

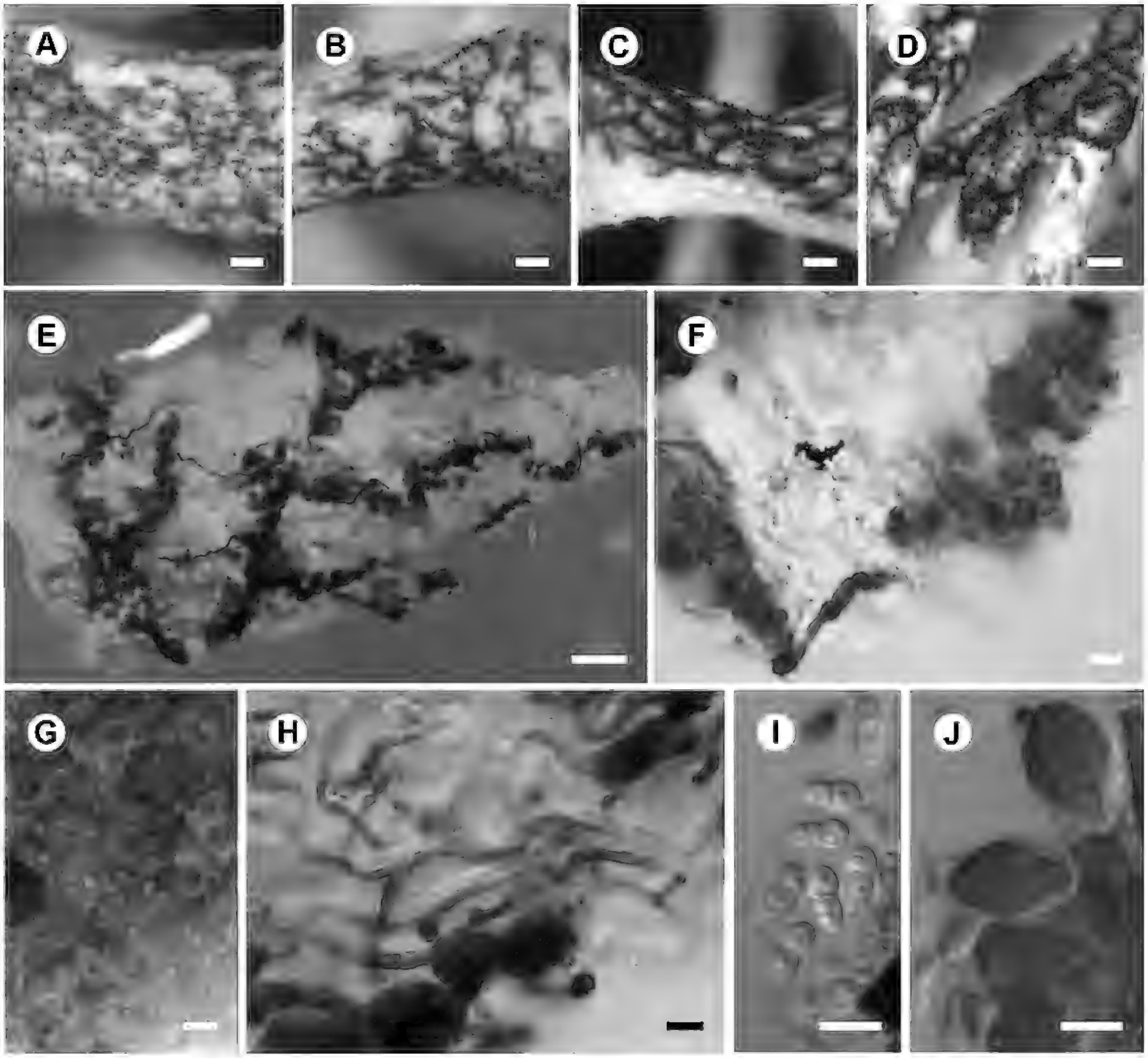

Figure 13. *Sphaerellothecium cladoniicola* (A and B from LE 308584; C, D, F and G from LE 308493; E from LE 308564; H–J from LE 308491). **A–D,** infections with different degrees of development of dark stripes on the host surface. **E–G,** squashed sections of the host podetia in water, showing dark stripes and vegetative hyphae. **H,** vegetative hyphae occasionally growing inside hyphae of the host thallus in K. **I,** ascospores in BCr. **J,** asci in BCr. Scale bars: A–D = 200 µm, E = 50 µm, F–J = 10 µm.

Highway, 64°04'N, 147°27'W, elev. 850 m, 3.ix.2000, on basal squamules of neighbouring *C. coccifera* and *C. pocillum*, *M.P. Zhurbenko 00265a* (LE 309157). **CANADA. BRITISH COLUMBIA:** Kamloops, 50°40'N, 120°09'W, elev. 400 m, 25.vii.2002, on *C. pyxidata* (basal squamules, podetia), *M.P. Zhurbenko 02124* (LE 308732).

Sphaerellothecium cladoniicola **E.S. Hansen & Alstrup**

FIGURE 13

DESCRIPTION. – *Vegetative hyphae* mostly superficial, sometimes distinctly elevated above the host surface, appearing dark brown by reflected light, branched, medium brown to olive brown in transmitted light, often associated with conspicuous medium to dark brown or almost black, branched, flexuous stripes 40–80 µm wide (stripes composed of aggregations of medium to dark reddish brown subglobose cells of unclear origin, usually more or less protruding over the host thallus surface, sometimes becoming crest-like, and occasionally fuseed in irregular patches), strongly flexuose, mainly one cell thick, single cells (5.0–)5.7–10.3(–16.1) × (3.2–)4.4–6.8(–7.7) µm (n = 32), occasionally including segments with more than

one row of cells, but parallel, agglutinated hyphae not observed, with rough surface, septate, usually distinctly constricted at the septa, some vegetative hyphae composed of smooth-walled, longer and thinner cells 2–4 µm in diameter grow inside the hyaline hyphae of the host thallus (being wrapped by the latter). *Ascomata* perithecia, 25–35(–50) µm in diameter, superficial. *Asci* mostly ovoid, 21–26 × 13.5–15 µm, wall BCr– [(reaction with BCr was not mentioned in the protologue (Hansen & Alstrup 1995)]. *Ascospores* hyaline, soleiform/narrowly ovoid with wider upper cell, (9.5–)9.9–11.5 × 4.2–4.8(–5.0) µm, l/b = (2.1–)2.2–2.6(–2.7) (n = 12, in water or BCr), 1-septate, constricted at the septum, usually with 1–3 large guttules in each cell, distinct halo not observed, wall BCr–.

NOTES. – In the protologue Hansen and Alstrup (1995) did not mention the dark stripes associated with vegetative hyphae, but instead described a superficial reticulate mycelium composed of parallel, agglutinated hyphae which we have not observed in the examined material. It is possible that they interpreted the stripes as belonging to vegetative hyphae. However, based on our observations, the stripes originate from the host thallus and are induced by the parasite infection. The vegetative hyphae growing inside the host hyphae have also not been noted before and are reminiscent of *Taeniolella cladinicola* Alstrup (Alstrup 1993b).

This species was found on both healthy-looking and decaying podetia of *Cladonia arbuscula* (most occurrences), *C. mitis*, *C. rangiferina*, *C. stellaris* and *C. stygia*. Host thalli become discolored or darkened by especially heavy infections. The species is widely distributed in the Holarctic, including the polar desert biome. It has been previously documented in Russia and Asia only from Chukotka and Magadan Regions of Russia (Hansen & Alstrup 1995, Zhurbenko & Zheludeva 2015). A report from Turkey (Kocakaya et al. 2016) was based on a misidentification of *Sphaerellothecium cladoniae* (revised by R. Pino-Bodas, 2016). We here report the species for the first time from Mongolia.

Specimens examined. – **NORWAY. SVALBARD:** Aldegondabreen glacier, 78º00'N, 14º12'E, elev. 15 m, 15.vii.2003, on *Cladonia mitis* (podetia), *M.P. Zhurbenko 03178* (LE 308582). **RUSSIA. KRASNOYARSK TERRITORY:** Severnaya Zemlya Archipelago, Bol'shevik Island, Akhmatov Bay, 79°03'N, 102°41'E, elev. 450 m, 16.vii.1996, on *C. arbuscula* (podetia), *M.P. Zhurbenko 961031* (LE 308917); 17.vii.1996, *M.P. Zhurbenko 96408* (LE 308551); Cape Antsev, 78°13'N, 103°15'E, 1.viii.1997, on *C. rangiferina* (podetia), *N.V. Matveeva s.n.* (LE 308904); Taimyr Peninsula, Osipovka River, 72°42'N, 80°51'E, elev. 50 m, 18.vii.1990, on *C. arbuscula* (podetia), *M.P. Zhurbenko 901104* (LE 308564); Taimyr Peninsula, Dikson Island, 73°30'N, 80°20'E, elev. 30 m, 7.vii.1990, on *C. arbuscula* (podetia), *M.P. Zhurbenko 901108* (LE 308577); Taimyr Peninsula, Uboinaya River, 73°25'N, 82°51'E, elev. 150 m, 5.viii.1990, on *C. arbuscula* (podetia), *M.P. Zhurbenko 901109* (LE 308580); Taimyr Peninsula, Levinson-Lessinga Lake, 74°31'N, 98°27'E, elev. 450 m, 10.viii.1995, on *C. arbuscula* (podetia), *M.P. Zhurbenko 95596* (LE 308894). **REPUBLIC OF BURYATIA:** Kitoi Mts., 3 km N of Oka Lake, 51°55'N, 100º40'E, elev. 2000 m, 15.vi.2005, on *C. arbuscula* (podetia), *M.P. Zhurbenko 05172* (LE 309163); Dzherginskii Reserve, Balan-Tamur Lake, 55°14'10"N, 111°42'15"E, elev. 1200 m, 23.vii.2000, on *C. stygia* (podetia), *T.M. Kharpukhaeva s.n.* (LE 309161). **REPUBLIC OF SAKHA (YAKUTIA):** 3 km SW of Tiksi, 71°40'N, 128°40'E, elev. 50 m, 17.vii.1998, on *C. arbuscula* (podetia), *M.P. Zhurbenko 98413* (LE 308890). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Mt. Lysaya, 45°00'14"N, 136°30'00"E, elev. 850 m, 2.ix.2013, on *C. arbuscula* (podetia), *M.P. Zhurbenko 13140* (H, LE 308491), on *C. mitis* (podetia), *M.P. Zhurbenko 13151a* (H, LE 308493), on *C. stellaris* (podetia), *M.P. Zhurbenko 13150* (LE 308492). **MAGADAN REGION:** Magadan, Mt. Nagaevskaya, 59°34'N, 150°45'E, elev. 400 m, 2.vii.2001, on *C. arbuscula* (podetia), *D.S. Lysenko s.n.* (LE 308550). **CHUKOTKA AUTONOMOUS AREA:** Wrangel' Island, Kulikovyi Creek, 70°58'N, 179°00'E, elev. 140 m, 23.viii.1992, on *C. rangiferina* (podetia), *S.S. Kholod s.n.* (LE 308879); Somnitel'naya River, 71°59'N, 179°38'W, elev. 170 m, 9.viii.1984, on *C. arbuscula* (podetia), *S.S. Kholod s.n.* (LE 308583); Anyui Upland, Elvinei-Veem River, 21.vi.1967, on *C. arbuscula* (podetia), *B.A. Yurtsev s.n.* (LE 308764); Inchoun, 66°17'N, 170°17'W, 2.viii.1975, on *C. stygia* (podetia), *I.I. Makarova s.n.* (LE 308790); Enurmino, 66°56'N, 171°49'W, 1.viii.1972, on *C. arbuscula* (podetia), *I.I. Makarova s.n.* (LE 308799); Baran'e Lake, 66°54'N, 175°15'E, 24.vii.1980, on *C. rangiferina* (podetia), *I.I. Makarova s.n.* (LE 308769); km 174 of road from Egvekinot to Iul'tin, 67°41'N, 178°35'W, 10.viii.1979, on *C. rangiferina* (podetia), *I.I. Makarova s.n.* (LE 308803). **MONGOLIA. ARA-KHANGAI AIMAK:** Terkhiin-Tsagan-Nur Lake, 48°10'N, 99°43'E, elev. 2100 m, 21.viii.1972, on *C. stellaris* (podetia), *L.G. Biazrov* 1828 (LE 308850). **U.S.A. ALASKA:** Seward Peninsula, Guy Rowe Creek, 64.7577°N, 163.8872°W, elev. 321 m, 2000, on *C. arbuscula* (podetia), *D.A. Walker s.n.* (LE

309162); Great Kobuk Sand Dunes, 67°04'N, 158°54'W, elev. 50 m, 1.viii.2000, on *C. mitis* (podetia), *M.P. Zhurbenko 00480* (LE 309159); Wrangell Saint Elias Park and Preserve, Chititu Ridge, 61.2523°N, 142.5560°W, elev. 1364 m, 16.vii.2004, on *C. arbuscula* (podetia), *J. Roth s.n.* (LE 308584). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Mt. Raft, 51°44'N, 119°50'W, elev. 2100 m, 3.viii.2002, on *C. mitis* (podetia), *M.P. Zhurbenko 02350* (LE 308731).

***Stigmidium cladoniicola* Zhurb. & Diederich**

NOTES. – In the specimens examined the ascospores measured (9.0–)11.5–14.3(–16.5) × (3.0–)3.4–4.2(–5.0) µm, l/b = (2.2–)3.0–3.8(–5.0) (n = 141, in water or BCr). It was found on the podetia and occasionally basal squamules of *Cladonia coccifera* (most occurrences), *C. metacorallifera*, *C. squamosa* and an unidentified *Cladonia* species. Infected parts of the host were often moribund and bleached. The species was previously known in Asia only from Korea (Kondratyuk et al. 2016) and in Russia only from Northern Ural (Zhurbenko & Diederich 2008). Here we report it for the first time from Asian Russia. *Cladonia coccifera*, *C. metacorallifera* and *C. squamosa* are new host species.

Specimens examined. – **RUSSIA. MURMANSK REGION:** Barents Sea coast, Dal'ne-Zelenetskaya Bay, 69°07'N, 36°05'E, elev. 20 m, 22.viii.1997, on *Cladonia coccifera* (podetia), *M.P. Zhurbenko 97417* (LE 308915); Olenka River mouth, 69°02'N, 36°24'E, elev. 50 m, 5.ix.1997, on *C. squamosa* (bleached podetia), *M.P. Zhurbenko 97406b* (LE 308893); on *C. coccifera* (moribund podetia), *M.P. Zhurbenko 97410a* (LE 308906). **NENETS AUTONOMOUS AREA:** Malozemel'skaya tundra, Peschanka Lake, 68°46'24"N, 53°14'36"E, 21.viii.1998, on *C. metacorallifera* (podetia), *O.V. Lavrinenko s.n.* (LE 308934a). **KOMI REPUBLIC:** Northern Ural, Yanypupuner Range, 62°04'N, 59°08'E, elev. 500 m, 4.vii.1997, on *Cladonia* sp. (moribund podetia and basal squamules), *M.P. Zhurbenko 97403* (LE 308552, topotype). **KRASNOYARSK TERRITORY:** Taimyr Peninsula: Levinson-Lessinga Lake, 74°24'N, 98°46'E, elev. 120 m, 28.viii.1995, on *C. coccifera* (moribund podetia), *M.P. Zhurbenko 95602* (LE 308936). **TRANS-BAIKAL TERRITORY:** Kodar Range, Olenii Rog Creek, 56°47'57"N, 117°21'59"E, elev. 1674 m, 18.vi.2015, on *Cladonia* sp. (bleached podetia), *L.A. Konoreva s.n.* (LE 309332b).

***Taeniolella beschiana* Diederich**, Bull. Soc. Nat. Luxemb. 93: 156. 1992. TYPE: Luxembourg, Mersch, Fischbach, 15.xi.1980, on *Cladonia chlorophaea*, *P. Diederich 3480* (LG, holotype).

Syn. nov. *Ameroconium cladoniae* U. Braun & Zhurb. *in* Zhurbenko & Braun, Lichenologist 45: 584. 2013. TYPE: Russia, Irkutsk Region, near Erbogachen, 60°59'15"N 108°28'55"E, 10.ix.2008, on *Cladonia rangiferina*, *K.E. Vershinin s.n.* (LE 260838!, holotype).

NOTES. – When describing this lichenicolous hyphomycete that occurs on *Cladonia* species, Diederich (1992) mentioned that it differs from *Taeniolella* S. Hughes s. str. Later a new hyphomycetous genus, *Ameroconium* U. Braun & Zhurb., was introduced to accommodate *A. cladoniae* also growing on species of *Cladonia* (Zhurbenko & Braun 2013) and clearly differing from *Taeniolella*, as described in Seifert et al. (2011), by its percurrently proliferating conidiogenous cells with distinct flaring annellations. Morphological examination of extensive additional material convinced us that *T. beschiana* and *A. cladoniae* belong to the same widespread, common and morphologically variable species and thus are synonymized here. The conidiophores are occasionally branched in the lower part, conidia are quite variable, ranging from smooth and aseptate (as was described for *A. cladoniae*) to often verruculose and occasionally up to 3-septate, subhyaline to mostly light or medium brown, (5.0–)6.5–9.5(–12.8) × (2.5–)3.2–4.4(–5.7) µm, l/b = (1.4–)1.7–2.5(–3.6) (n = 157), solitary or occasionally in short chains.

This species was found on the podetia and/or basal squamules of *Cladonia* cf. *alaskana*, *C. amaurocraea*, *C. arbuscula*, *C. bellidiflora*, *C. cariosa*, *C. carneola*, *C. cervicornis*, *C. coccifera*, *C. coniocraea*, *C. cornuta*, *C. cyanipes*, *C. deformis*, *C. digitata*, *C.* cf. *ecmocyna*, *C. gracilis*, *C. mitis*, *C. ochrochlora*, *C. phyllophora*, *C. pocillum*, *C. pyxidata*, *C. rangiferina*, *C. stellaris*, *C. stricta*, *C. subulata*, *C. sulphurina*, *C. symphycarpa*, *C. umbricola* and unidentified *Cladonia* species. In some cases it formed continuous black patches on the host thalli, but distinct pathogenicity not observed. The taxon is widely distributed in the Holarctic including the tundra biome, but not known from the polar desert biome. Here we report it for the first time from Mongolia. *Cladonia amaurocraea*, *C. bellidiflora*, *C. cariosa*, *C. cyanipes*, *C. stellaris*, *C. sulphurina* and *C. umbricola* are new host species.

Specimens examined. – **SPAIN. TOLEDO:** Aldeanueva de Barbarroya, 39°44'46"N, 5°02'00.0"W, elev. 480 m, 20.iii.2014, on *Cladonia cervicornis* (basal squamules, mostly their undersides), *R. Pino-Bodas s.n.* (H). **NORWAY. TROMS CO.:** Skibotndalen Valley, 69°19.4'N, 20°21.4'E, elev. 70 m, 6.viii.2003, on *C.* cf. *arbuscula* (podetia), *M.P. Zhurbenko 0331* (LE 309046); 69°13'N, 20°29'E, elev. 650 m, 8.viii.2003, on *C. coccifera* (basal squamules, occasionally podetia), *M.P. Zhurbenko 03109* (LE 309049). **RUSSIA. MURMANSK REGION:** Dal'ne-Zelenetskaya Bay, 69°07'N, 36°05'E, elev. 20 m, 22.viii.1997, on *C. bellidiflora* (basal squamules, podetia), *M.P. Zhurbenko 97413* (LE 308910); 5 km S of Dal'nie Zelentsy, 69°03'N, 36°05'E, elev. 100 m, 2.ix.1997, on *Cladonia* sp. (basal squamules, podetia), *M.P. Zhurbenko 97408* (LE 308899); Khibiny Mts., Mt. Vud'yavrchorr, 67°40'N, 33°32'E, elev. 900 m, 7.viii.1997, on *C. mitis* (podetia), *M.P. Zhurbenko 97412* (LE 308909); Mt. Kukisvumchorr, 67°42'N, 33°36'E, elev. 450 m, 9.viii.1997, on *C. arbuscula* (podetia), *M.P. Zhurbenko 9717a* (LE 308940a). **REPUBLIC OF ADYGEYA:** Caucasus, headwaters of Armyanka River, 44°00'33"N, 39°59'42"E, elev. 1680 m, 24.viii.2014, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 14275* (LE 308606); Guzeripl', 43°59'25"N, 40°08'56"E, elev. 770 m, 13.viii.2014, on *C. coniocraea* (basal squamules), *M.P. Zhurbenko 14274* (LE 308605). **KRASNODAR TERRITORY:** Caucasus, Lagonaki Upland, Mt. Fisht, 43°57'34"N, 39°55'48"E, elev. 1580 m, 17.viii.2014, on *C.* cf. *phyllophora* (podetial squamules), *M.P. Zhurbenko 14299* (LE 309043). **NENETS AUTONOMOUS AREA:** Bol'shezemel'skaya tundra, Ortin River, 67°50'04"N, 54°04'35"E, 28.vi.1999, on *C. rangiferina* (podetia), *O.V. Lavrinenko s.n.* (LE 308930). **KOMI REPUBLIC:** Northern Ural, Yanypupuner Range, 62°05'N, 59°06'E, elev. 800 m, 3.vii.1997, on *C. mitis* (decaying podetia), *M.P. Zhurbenko 97242b* (LE 210227b). **KRASNOYARSK TERRITORY:** Taimyr Peninsula, Uboinaya River mouth, 73°39'N, 82°22'E, elev. 15 m, 15.viii.1990, on *C. stricta* (basal squamules, podetia), *M.P. Zhurbenko 901085b* (LE 308571b); Taimyr Peninsula, Pyasina River mouth, 74°08'N, 86°44'E, 22.vii.1993, on *C. stricta* (podetia), *V.B. Kuvaev 1968* (LE 308517); Taimyr Peninsula, Levinson-Lessinga Lake, 74°24'N, 98°46'E, elev. 120 m, 28.viii.1995, on *C. stricta* (podetia), *M.P. Zhurbenko 95601* (LE 308932); 74°24'N, 98°38'E, elev. 150 m, 1.viii.1995, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 95213* (LE 309448); Taimyr Peninsula, Khatanga, 71°58'N, 102°27'E, 4.ix.1995, on *C. stricta* (podetia), *M.P. Zhurbenko 95595* (LE 308892); Eastern Sayan Mts., Kryzhina Range, Belyi Kitat River, 53°59'N, 95°27'E, elev. 1550 m, 5.vii.2009, on *C. digitata* (basal squamules, podetia), *M.P. Zhurbenko 0947b* (LE 308654b); elev. 1400 m, 7.vii.2009, on *C. phyllophora* (basal squamules, podetia), *M.P. Zhurbenko 0946b* (LE 308653b); 54°00'N, 95°29'E, elev. 1400 m, 20.vii.2009, on *C. rangiferina* (podetia), *M.P. Zhurbenko 0945a* (LE 308652a); Western Sayan Mts., Ergaki Nature Park, Bol'shaya Baklanikha River, 52°46'N, 93°19'E, elev. 1150 m, 24.vii.2010, on neighbouring *C. coccifera* and *C. sulphurina* (basal squamules, podetia), *M.P. Zhurbenko 1051a* (LE 308686a). **REPUBLIC OF TUVA:** Todzhinskaya trough, headwaters of Dugdu River, 24.vii.1999, on *C. deformis* (basal squamules), *N.I. Molokova s.n.* (LE 210263b). **TRANS-BAIKAL TERRITORY:** Sokhondinskii Reserve, Nar'ya Lake, elev. 1750 m, on *C. stellaris* (podetia), 11.1988, *A.A. Nikol'skii s.n.* (LE 308868). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Dal'negorsk, 44°35'48"N, 135°33'12"E, elev. 240 m, 18.viii.2013, on *C. pocillum* (basal squamules, podetia), *M.P. Zhurbenko 13145a* (H, LE 308494); Sikhote-Alin' Range, headwaters of Valinku River, 46.1440°N, 136.7073°E, elev. 1300 m, 26.viii.2013, on *C. pyxidata* (basal squamules, occasionally podetia), *Yu.V. Gerasimova s.n.* (LE 308697); Sikhote-Alin' Range, Yasnaya (Maisa) River, 45°14'22"N, 136°29'22.4"E, elev. 160 m, 24.viii.2013, on *C. coniocraea* (basal squamules), *M.P. Zhurbenko 13160* (LE 308636); Sikhote-Alin' Range, Zabolochennaya (Tun'sha) River, 45°13'42.8"N, 136°31'04.5"E, elev. 150 m, 26.viii.2013, on *Cladonia* sp. (basal squamules, podetia), *M.P. Zhurbenko 13170* (LE 308687). **SAKHALIN REGION:** Iturup Island, Baranovskogo volcano, 43°39'N, 131°55'E, 6.x.1996, on *C. coccifera* (basal squamules, podetia), *A.A. Dobrysh s.n.* (LE 308833). **CHUKOTKA AUTONOMOUS AREA:** Tamvatvaam River, 63°38′N, 174°50′E, 24.vii.1983, on *C. pocillum* (basal squamules), *I.I. Makarova s.n.* (LE 308835); Iskaten' pass, 66°35'N, 179°10'E, 4.vii.1971, on *C. coccifera* (podetia), *I.I. Makarova s.n.* (LE 308829); km 36 of road from Egvekinot to Iul'tin, 66°35'N, 179°10'E, 14.vii.1971, on *Cladonia* sp. (basal squamules), *I.I. Makarova s.n.* (LE 308749); 45 km WSW of Ust'-Chauna, Mt. Pynei, 3.vi.1951, on *C. amaurocraea* (podetia), *I. Shmorunova s.n.* (LE 308810b). **MONGOLIA. ARA-KHANGAI AIMAK:** watershed of Khukh-Sumein-Gol and Tsetserleg-Gol Rivers, Mt. Khairkhan, 47°15'N, 101°50'E, elev. 2400 m, 20.viii.1977, on *C. rangiferina* (podetia), *L.G. Biazrov 6551b* (LE 308851b); elev. 2100 m, 1.viii.1979, on *C. ochrochlora* (basal squamules, podetia), *L.G. Biazrov 3385b* (LE 308869b); headwaters of Khukh-Sum-Gol River, 47°15'N, 101°50'E, elev. 2000 m, 20.vii.1975, on *C. ochrochlora* (basal squamules), *L.G. Biazrov 6240* (LE 308843). **U.S.A. ALASKA:**

Seward Peninsula, 7 km NE of Nome, Newton Peak, 64°33'N, 165°22'W, elev. 250 m, 5.ix.2001, on *C. symphycarpa* (both sides of basal squamules), *M.P. Zhurbenko 01102* (LE 309446); Seward Peninsula, 7 km ESE of Nome, 64°28'44"N, 165°16'03"W, elev. 5 m, 1.ix.2001, on *C. rangiferina* (moribund podetia), *M.P. Zhurbenko 0142b* (LE 308589b); Toolik Lake, 68°37'42"N, 149°35'52"W, elev. 770 m, 28.viii.2001, on *C. coccifera* (basal squamules, podetia), *M.P. Zhurbenko 01154* (LE 309051); on *C. trassii* (podetia), *M.P. Zhurbenko 01454* (LE 309054); Howe Island, 70°18'55"N, 147°59'35"W, elev. 17 m, 5.viii.2003, on *C. coccifera* (podetia and basal squamules), *D.A. Walker s.n.* (LE 308504a); Great Kobuk Sand Dunes, 67°06'N, 159°01'W, elev. 50 m, 4.viii.2000, on *C. symphycarpa* (basal squamules), *M.P. Zhurbenko 00119a* (LE 309041a); 67°07'N, 159°03'W, elev. 40 m, 9.viii.2000, on *C. pyxidata* (basal squamules), *M.P. Zhurbenko 00110* (LE 309447); Susitna River, 62.338439°N, 150.226826°W, elev. 130 m, 2.viii.2013, on *C.* cf. *ecmocyna* (podetia), *G.V. Frost s.n.* (LE 308545); Fairbanks, 64°49.236'N, 147°45.498'W, 3.viii.2004, on *C. rangiferina* (podetia), *M.P. Zhurbenko 0476a* (LE 309053a); 64°49.583'N, 147°45.513'W, 9.viii.2004, on *C.* cf. *alaskana* (podetia), *M.P. Zhurbenko 04111* (LE 309044); 64°51.956'N, 147°52.494'W, elev. 170 m, 14.viii.2004, on neighbouring *C. cornuta* and *C. cyanipes* (podetia), *M.P. Zhurbenko 04158* (LE 309047); Goldstream Valley, 64°57.188'N, 147°42.775'W, 31.vii.2004, on *C. cornuta* (podetia), *M.P. Zhurbenko 0468b* (LE 309060b); on *C. cyanipes* (podetia), *M.P. Zhurbenko 0467b* (LE 309140b); Skyline Ridge, 64°55.270'N, 147°43.001'W, elev. 470 m, 31.vii.2004, on *C. gracilis* (podetia), *M.P. Zhurbenko 04378b* (LE 309055b); Tanana River, Bonanza Creek, 64°51.320'N, 147°49.189'W, elev. 150 m, 21.viii.2004, on *C. cornuta* (podetia including podetial squamules), *M.P. Zhurbenko 04265b* (LE 309057b); on *C. cyanipes* (podetia), *M.P. Zhurbenko 04263* (LE 309048); 25.viii.2004, on *C. pocillum* (basal squamules, occasionally podetia), *M.P. Zhurbenko 04280* (LE 309050); Denali National Park and Preserve, 63°43.35'N, 148°57.53'W, elev. 700 m, 17.viii.2004, on *C. subulata* (podetia), *M.P. Zhurbenko 04214a* (LE 309040a); on *C. cariosa* (basal squamules), *M.P. Zhurbenko 04219* (LE 309042); 20.viii.2004, on *C. pyxidata* (basal squamules), *M.P. Zhurbenko 04188a* (LE 309045a); 63°43'N, 149°07'W, elev. 900 m, 30.viii.2000, on *C. coccifera* (basal squamules), *M.P. Zhurbenko 00329* (LE 309052). **CANADA. BRITISH COLUMBIA:** Wells Gray Provincial Park, Raft Mt., 51°44'N, 119°50'W, elev. 2100 m, 3.viii.2002, on *Cladonia* sp. (basal squamules), *M.P. Zhurbenko 02315* (LE 308701); on *C.* cf. *stellaris* (podetia), *M.P. Zhurbenko 02310* (LE 308703); Battle Creek Valley, elev. 750 m, 5.viii.2002, on *C. ochrochlora* (podetia), *M.P. Zhurbenko 02402* (LE 308712); Philip Creek, 52°52'N, 120°00'W, elev. 800 m, 30.vii.2002, on *C.* cf. *cervicornis* (basal squamules, podetia), *M.P. Zhurbenko 02155a* (LE 308704a); Spahats Creek, 51°44'23"N, 120°00'23"W, elev. 770 m, 10.vii.2002, on *C. phyllophora* (podetia), *M.P. Zhurbenko 02281b* (LE 308727b); Columbia Mts., Glacier National Park, Beaver River, 51°18'N, 117°24'W, elev. 1100 m, 17.vii.2002, on *C. sulphurina* (podetia), *M.P. Zhurbenko 0215c* (LE 308706c); 51°15'N, 117°22'W, elev. 1150 m, 17.vii.2002, on *C. umbricola* (basal squamules), *M.P. Zhurbenko 02100a* (LE 308755). **NEWFOUNDLAND AND LABRADOR:** Newfoundland, Main River Provincial Park, 49°48'21"N, 57°21'26"W, 480 m, 7.ix.2011, on *C. carneola* (tips of podetia), *T. Ahti 70807* (H).

***Tremella cladoniae* Diederich & M.S. Christ.**

NOTES. – Lunate conidia were observed in LE 309191 and are here reported for this species for the first time (Diederich 1996). *Cladonia gracilis* is also a new host species.

Specimens examined. – **RUSSIA. MURMANSK REGION:** Iolgi-Tundry Mts., Maloe Glubokoe Lake, 67°12'40"N, 33°14'40"E, elev. 150 m, 23.vii.2001, on *Cladonia gracilis* (podetia), *I.S. Zhdanov s.n.* (LE 309191). **REPUBLIC OF BURYATIA:** Barguzin Range, Mt. Gol'makta, 53°55'11"N, 109°57'07"E, elev. 700 m, 28.viii.2002, on *C. pyxidata* (podetia), *M.P. Zhurbenko 02409* (LE 309187).

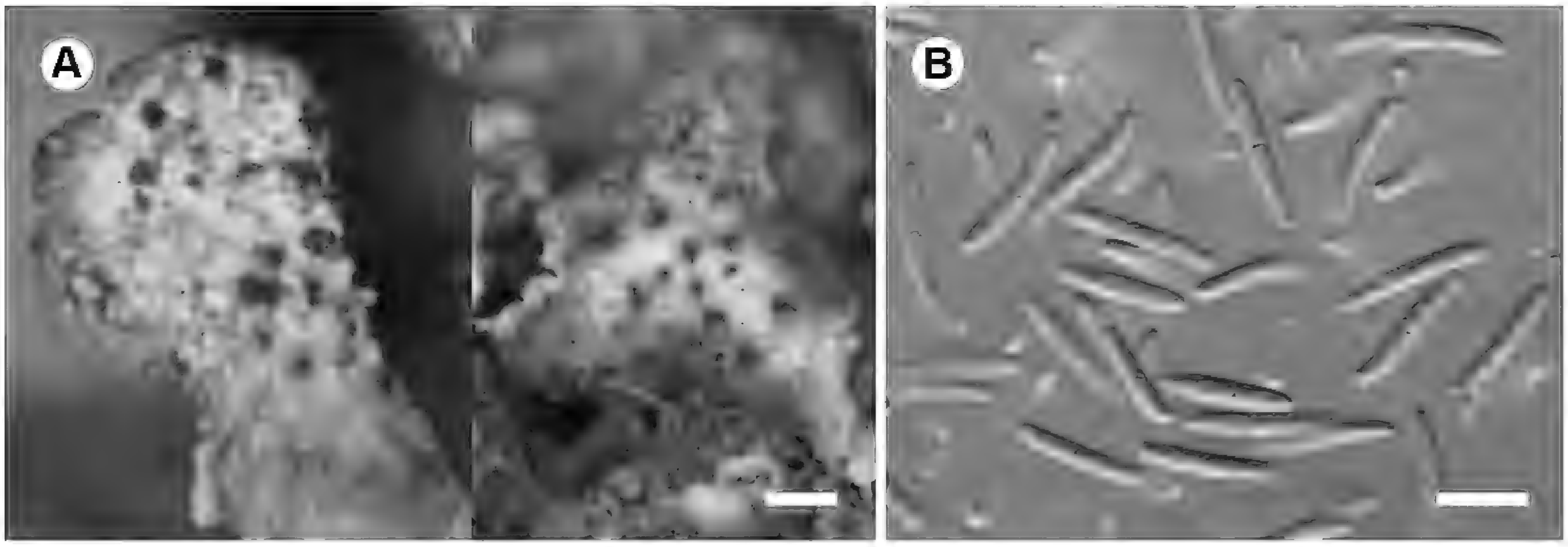

Figure 14. A presumably undescribed coelomycete growing on *Cladonia* spp. **A,** conidiomata (left, *Biazrov 1609*; right, *Biazrov 4110*). **B,** conidia in water (*Biazrov 4110*). Scale bars: A = 200 µm, B = 10 µm.

***Zwackhiomyces diederichii* D. Hawksw. & Iturr.**

DESCRIPTION. – *Ascomata* 75–180 µm in diameter, protruding in the upper part, dispersed to loosely aggregated; wall orangish brown or brown, pigmentation heterogeneous, with an olive grey tinge in K. *Interascal hyphae* hyaline, filiform, (0.5–)1–2(–3.5) µm in diameter, scarcely branched and anastomosed, apically not swollen. *Hymenial gel* I and K/I–. *Asci* subcylindrical to slightly wider in the center or lower half, apex sometimes truncate, (35–)38–52(–63) × (6.5–)7–9(–10.5) µm (n = 28, in water, I or K/I), 8-spored. *Ascospores* narrowly obovoid, upper cell wider and occasionally up to twice longer than the lower one, (8.0–)9.6–12.4(–15.0) × (2.6–)3.1–3.9(–4.7) µm, l/b = (2.4–)2.8–3.6(–4.4) (n = 128, in water or I), 1-septate, occasionally slightly constricted at the septum, wall smooth [according to Aptroot et al. (1997) ascospores have a granulose perispore, which was not observed], sometimes guttulate, irregularly biseriate to diagonally uniseriate in the ascus.

NOTES. – We found this species on the podetia and/or basal squamules of *Cladonia arbuscula*, *C. coniocraea*, *C. ochrochlora*, *C. pocillum* and *C. rangiferina*. Heavy infections were observed to cause slight bleaching of host tissues. The species was previously known in Russia only from Karelia and Mordovia Republics (Alstrup et al. 2005, Urbanavichus & Urbanavichene 2014). *Cladonia arbuscula*, *C. pocillum* and *C. rangiferina* are new host species.

Specimens examined. – **LITHUANIA.** Asveja Regional Park, 55.073°N, 25.419°E, 22.ix.2011, on *Cladonia coniocraea* (upper side of basal squamules), *F. Högnabba 220911-15b* (H). **RUSSIA. REPUBLIC OF BURYATIA:** Dzherginskii Reserve, Balan-Tamur Lake, 55°14'10"N, 111°42'15"E, 23.vii.2000, on *C. rangiferina* (podetia), *T.M. Kharpukhaeva s.n.* (LE 309134). **PRIMORYE TERRITORY:** Sikhote-Alin' Range, Zabolochennaya River, 45°16'13"N, 136°29'56"E, elev. 220 m, 21.viii.2013, on *C. rangiferina* (moribund bases of podetia), *M.P. Zhurbenko 13164* (LE 308642); 45°14'07"N, 136°30'34"E, elev. 160 m, 21.viii.2013, on *C. ochrochlora* (upper side of basal squamules), *M.P. Zhurbenko 13144* (LE 308495); Sikhote-Alin' Range, 2.5 km from confluence of Dzhigitovka River and Kabanii Creek up the road to a pass, 45°07'37"N, 135°51'56"E, elev. 680 m, 6.ix.2013, on *C. coniocraea* (damaged podetia and basal squamules), *M.P. Zhurbenko 13138a* (LE 308496). **U.S.A. ALASKA:** Kotzebue, 66°53'N, 162°31'W, elev. 30 m, 19.viii.2000, on *C. arbuscula* (podetia), *M.P. Zhurbenko 00160b* (LE 309070b); Goldstream Valley, 64°57.16'N, 147°42.83'W, 12.viii.2004, on *C. arbuscula* (moribund parts of podetia), *M.P. Zhurbenko 04135b* (LE 309144b). **CANADA. BRITISH COLUMBIA:** Columbia Mts., Mount Revelstoke National Park, 18.vii.2002, on *C. pocillum* (basal squamules), *M.P. Zhurbenko 02401* (LE 308709).

Unidentified coelomycete with bacilliform (0–)1(–3)-transseptate conidia

FIGURE 14

DESCRIPTION. – *Conidiomata* pycnidial, blackish in the visible parts, ampulliform, 100–150 µm in diameter, immersed to slightly erumpent, with an irregular opening up to 15–55 µm lengthways; wall

yellowish-brown, darker above, paraplectenchymatous, K–. Distinct *conidiophores* not observed. *Conidiogenous cells* possibly acro-pleurogenous. *Conidia* bacilliform with rounded ends, straight to slightly curved, (10.2–)13.2–16.6(–19.8) × (2.0–)2.2–2.6(–3.1) µm, l/b = (3.4–)5.4–7.4(–9.4) (n = 93), hyaline, smooth, (0–)1(–3)-transseptate. Heavy infections seemingly discolor the host thallus.

NOTES. – No fungus with conidia such as those described above is known to occur on *Cladonia*. Nonetheless better developed material is necessary before it can be formally described.

Specimens examined. – **MONGOLIA. ARA-KHANGAI AIMAK:** 40 km of Tevshrulekh, 47°40'N, 102°14'E, elev. 1500 m, petrophytic steppe, 1.viii.1980, on *Cladonia pocillum* (basal squamules), *L.G. Biazrov 4110* (LE). **BULGAN AIMAK:** Mt. Tsetserleg-Ula, 47°30'N, 103°40'E, elev. 1950 m, *Ulmus* forest in a canyon, 29.vi.1972, on *C. pyxidata* (upper part of cups), *L.G. Biazrov 1609* (LE).

KEY TO THE LICHENICOLOUS FUNGI GROWING ON *CLADONIA*

This key is based on data from Brackel (2014), Lawrey & Diederich (2016), Zhurbenko & Alstrup (2004), the present contribution and literature cited in the key. Potentially confusing lichenized fungi or non-obligately lichenicolous fungi that occur on *Cladonia* are also included. Species that are not host specific to *Cladonia* are given in square brackets. Authors of fungal names are provided only for species not listed in the main part of the text above. The sizes of diaspores are rounded to 0.5 µm.

The myxomycete *Listerella paradoxa* E. Jahn also occurs on species of *Cladonia* and is sometimes included in lists of lichenicolous fungi (example: Hafellner 2008). It is not included in the key below, but can be recognized by the following characters: fruit bodies dull blackish-brown with shining yellow ridges, sessile, pulvinate, up to 0.3 mm in diameter, covered by membranous peridium, with capillitium consisting of dark, flexuous threads with regular bead-like annulations; spores light brownish-gray, black in mass, faintly spinulose, 7–8 µm in diameter (Ing 1999).

Key to keys

1. Hyphae with clamp connections, or if efibulate, then forming deep pink, orange-red, rose or yellow to orange bulbils .... **Key 1 (Page 244)**
1. Hyphae without clamp connections; bulbils absent 2
    2. Spores produced in asci 3
        3. Ascomata apothecioid, rarely lirellate or stromatic .... **Key 2 (Page 245)**
        3. Ascomata perithecioid or sometimes catathecioid .... **Key 3 (Page 248)**
    2. Spores not produced in asci 4
        4. Conidia produced in pycnidia or stromata .... **Key 4 (Page 253)**
        4. Conidia not produced in pycnidia or stromata .... **Key 5 (Page 255)**

Key 1. Basidiomycetes

1. Fructifications bulbils; hyphae with or without clamp connections 2
    2. Bulbils deep pink, orange-red or rose, composed of thin-walled cells mainly up to 10 µm in diameter. Lit.: Diederich (1990), Diederich & Lawrey (2007), Hawksworth (1979) .... **[*Marchandiomyces corallinus* (Roberge) Diederich & D. Hawksw.]**
    2. Bulbils yellow to orange, composed of thick-walled cells 10–20 µm in diameter. Lit.: Lawrey et al. (2016) .... ***Neoburgoa freyi***
1. Fructifications basidiomata, occasionally also sclerotia; hyphae with clamp connections 3
    3. Basidiomata agaricoid, differentiated into convex to plane brownish striate cap and cylindrical pruinose stem. Lit.: Antonín & Noordeloos (2004) .... **[*Gamundia striatula* (Kühner) Raithelh.]**
    3. Basidiomata not agaricoid 4

4. Basidiomata resupinate, pellicular, with orange-ochraceous irregularly folded hymenophore and scattered orange ovate sclerotia. Lit.: Thorn et al. (1998) .... **[*Leucogyrophana lichenicola* Thorn, Malloch & Ginns]**
4. Basidiomata different 5

5. Basidiomata usually elongate, sometimes roundish or tuberculate; mature basidia aseptate. Lit.: Diederich (1996), present paper .... ***Heterocephalacria bachmannii***
5. Basidiomata subglobose, pulvinate, tuberculate or irregular in form; mature basidia 1-septate 6

6. Basidiomata 0.1–2.2 mm in diameter; mature basidia mainly claviform, 20–36 µm long, with transverse septum; basidiospores subspherical, 7–10 × 6–8 µm. Lit.: Diederich (1996) .... ***Tremella cladoniae***
6. Basidiomata 0.2–0.8 mm in diameter; mature basidia subspherical or rarely ellipsoid, 8.5–14 µm long, with longitudinal or rarely oblique or transverse septum; basidiospores ellipsoid, 5.5–7.5(–8) × (3.5–)4–5.5 µm. Lit.: Diederich (1996) .... ***Tremella macroceratis* Diederich & Hafellner**

Key 2. Ascomycetes with apothecioid, rarely lirellate or stromatic ascomata

1. Ascomata lirellate, with a slit-like opening and a scarcely visible disc. Lit.: Ertz & Diederich (2003), present paper .... ***Opegrapha cladoniicola***
1. Ascomata different 2

2. Ascomata stromatic, multilocular, macroscopically resembling a single apothecium. Lit.: Ertz et al (2005) .... ***Plectocarpon cladoniae***
2. Ascomata different 3

3. Ascomata pin- or nail-like, consisting of heads at the tips of stalks 4

4. Apothecia light orange throughout; mazaedium absent; paraphyses present; ascospores hyaline. Lit.: Alstrup & Cole (1998) .... ***Bryoscyphus lichenicola* Alstrup & M.S. Cole**
4. Apothecia black, at least above; mazaedium present; paraphyses absent; ascospores pigmented 5

5. Stalks black; ascospores light brown, 1-septate, 6–7 × 2–3 µm; not lichenized; widespread. Lit.: Titov (2006) .... ***Chaenothecopsis parasitaster***
5. Stalks red; ascospores pale greenish, aseptate, (6–)7.5–8(10) × (2–)2.5–3(–3.5) µm; scarcely lichenized; known only from the type locality in China. Note: identification of *Cladonia* as a host lichen genus is uncertain. Lit.: Titov (2001), Wei & Titov (2001).. **[*Chaenothecopsis vinosa* Titov]**

3. Ascomata different 6

6. Ascomata convex, rounded; exciple indistinct or (in '*Arthonia*' *epicladonia*) poorly developed; paraphysoids branched and anastomosing; asci semi-fissitunicate, clavate to obovoid, stalked, usually with a K/I+ blue ring in the tholus; ascospores always or mainly septate 7

7. Hymenium covered by brown hairs 9–37 µm long. Lit.: Coppins & Aptroot (2009), Etayo (1996a), present paper .... **[*Arthonia coronata*]**
7. Hymenium not covered by hairs 8

8. Hymenium K+ purple; ascospores becoming gray. Lit.: Etayo (2002).. ***Arthonia colombiana* Etayo**
8. Hymenium not K+ purple; ascospores hyaline or brown 9

9. Hymenium K+ dirty violet, then gray; ascospores brown, finely verrucose. Lit.: Brackel (2010b) .... ***Arthonia coniocraeae* Brackel**
9. Hymenium K–; ascospores hyaline, smooth-walled 10

10. Ascospores (0–)2-septate, (9.5–)10.5–13.5(–16) × (3.5–)4–5(–6.5) µm. Lit.: Zhurbenko & Zhdanov (2013), present paper .. ***Arthonia* cf. *lepidophila***
10. Ascospores (0–)1-septate, of different size 11

11. Ascomata grayish to black, usually pruinose (better seen when wet); exciple present, but poorly developed; hymenium I+ blue; ascospores (12–)13.5–16.5(–18) × (3–)3.5–4.5(–5) µm. Source: A. Flakus, pers. comm., 2016.. ‘***Arthonia***’ ***epicladonia*** **(Nyl.) Alstrup & Zhurb.**

11. Apothecia black, epruinose; exciple absent; hymenium I+ red; ascospores shorter 12

12. Subhymenium light to medium brown/brownish orange; paraphysoids 1.5−3 µm wide, their end cells sometimes with distinct dark brown cap, usually enlarged up to 6 µm; ascospores (8–)10–13(–16.5) × (3.5–)4–5(–6.5) µm. Lit.: Hafellner (1999), present paper .... ***Arthonia digitatae***

12. Subhymenium medium brown; paraphysoids 2–4(–5) µm wide, their end cells often brown, enlarged up to 6(–8) µm; ascospores (8–)8.5–10(–12) × (3–)3.5–4(–4.5) µm. Lit.: Brackel (2015) .... ***Arthonia rangiformicola*** **Brackel & Etayo**

6. Species with a different combination of characters 13

13. Ascomata urceolate, initially sometimes almost closed 14

14. Ascospores muriform. Note: usually starting its life cycle as a lichen parasite without an own thallus, later becoming an independent lichen. Lit. Fletcher & Hawksworth (2009) .... **[*Diploschistes muscorum* (Scop.) R. Sant.]**

14. Ascospores transseptate 15

15. Ascospores mainly or always 1-septate 16

16. Ascospores 1-septate, acicular, helicoid or rarely straight, 22−31 × 1−2.5 µm; asci 16−32-spored; ascomatal disc brown. Lit.: Diederich (2004b) .... **[*Spirographa fusisporella* (Nyl.) Zahlbr.]**

16. Ascospores (0–)1(–2)-septate, slightly fusiform or slightly clavate (tapering down), occasionally almost bacilliform, straight, (7–)9.5–12.5(–14.5) × 1.5–2 µm; asci 8-spored; ascomatal disc light to medium yellow or yellowish white. Lit.: Pino-Bodas et al. (in press) .... ***Cryptodiscus galaninae*** **Zhurb. & Pino-Bodas ined.**

15. Ascospores with more than 1 septum 17

17. Ascomata fleshy, vinaceous, cinnamon or orange-brown; ascospores ellipsoid, (12−)15−20(−28) × (4−)4.5−5.5(−6.5) µm, 3-septate. Lit.: Zhurbenko & Etayo (2013) .... **[*Biazrovia stereocaulicola*]**

17. Ascomata of different color; ascospores subcylindrical, longer and narrower, with more than 3 transsepta 18

18. Ascomata and disc light orange-yellow, with white pruinose rim above; hymenium more than 70 µm tall, I and K/I–; asci longer 70 µm; ascospores (37–)50–72.5(–87) × 1.5–2 µm, (5–)7–11-transseptate. Lit.: Pino-Bodas et al. (in press)... ***Cryptodiscus epicladonia*** **Zhurb. & Pino-Bodas ined.**

18. Ascomata brownish black, without white rim; hymenium up to 70 µm tall, I+ red, K/I+ blue; asci up to 70 µm long; ascospores ca. 40–60 × 1.5–2 µm, presumably 4–5-septate. Lit.: Pino-Bodas et al. (in press); Rehm 1882, 1912; Saccardo 1889 .... ***Stictis cladoniae*** **(Rehm) Sacc.**

13. Ascomata not urceolate 19

19. Ascospores hyaline 20

20. Apothecial disc light to occasionally moderately pigmented 21

21. Ascospores aseptate 22

22. Asci with a K/I+ blue apical ring; ascospores 5–8 × 1–2.5 µm. Lit.: Kondratyuk & Galloway (1995), present paper ...... ***Pezizella ucrainica***

22. Asci with a K/I+ blue outer layer and K/I+ blue apical dome penetrated by a narrow canal surrounded by a K/I+ dark blue tube; ascospores 6–9 × 2.5–4 µm. Lit.: Brackel (2016) .... ***Micarea kemmleri* Brackel**

21. Ascospores septate 23

23. Ascospores 11–18.5 × 4.5–7.5 µm, ellipsoid. Note: this is a lichen with a quite inconspicuous thallus, occasionally growing on other lichens. Lit.: Scheidegger (1985) .... **[*Anzina carneonivea*]**

23. Ascospores (13.5–)17–23(–26) × (2–)2.5–3(–3.5) µm, cylindrical to slightly fusiform. Lit.: Hawksworth & Santesson (1990), Pino-Bodas et al. (in press) .... ***Cryptodiscus cladoniicola* (D. Hawksw. & R. Sant.) Pino-Bodas, Zhurb. & S. Stenroos ined. (≡ *Lettauia cladoniicola* D. Hawksw. & R. Sant.)**

20. Apothecial disc dark pigmented to black 24

24. Ascospores exclusively or mostly aseptate... 25

25. Ascomata 50–250 µm in diameter, immersed, then superficial; epihymenium very distinct; asci K/I+ pale blue; ascospores aseptate, (7–)8.5–10(–11) × (2.5–)3–3.5(–4) µm. Lit.: Diederich (2004a), present paper .... ***Phaeopyxis punctum***

25. Ascomata (30–)55–90(–120) µm in diameter, superficial; epihymenium indistinct; asci K/I–; ascospores 0(–1)-septate, (5.5–)6–9(–11) × 1.5–2(–3) µm. Lit.: present paper .. ***Brackelia lunkei***

24. Ascospores exclusively or mostly septate 26

26. Ascospores 12–28(?)-transseptate. Lit.: Santesson & Tønsberg (1994) .... ***Arthrorhaphis aeruginosa***

26. Ascospores 0–3-septate 27

27. Ascomata usually with a distinct stipe 40–100 µm tall, which is much paler than the disc; epihymenium distinct; asci with distinct external amyloid gelatinous cap; ascospores hyaline or rarely light brown, mainly 10.5–13 × 3.5–4.5 µm, (0–)1-septate, smooth. Lit.: Pino-Bodas et al. (in press) .... ***Dactylospora ahtii* Zhurb. & Pino-Bodas ined.**

27. Ascomata without a stipe or rarely with a stipe shorter than 40 µm, concolorous with the disc; epihymenium indistinct; asci without distinct external amyloid gelatinous cap; ascospores hyaline, mainly 13–16.5 × 5.5–6.5 µm, (0–)1(–3)-septate, granulate. Lit.: Alstrup & Hawksworth (1990), Pino-Bodas et al. (in press)............... **'*Scutula*' *cladoniicola* Alstrup & D. Hawksw.**

19. Ascospores pigmented 28

28. Ascospores strongly thickened at the apices and around the septum, with torus. Lit.: Alstrup & Hawksworth (1990) .... **[*Rinodina egedeana* (Linds.) Alstrup & D. Hawksw.]**

28. Ascospores not thickened at the apices and around the septum, without torus 29

29. Ascomata strongly convex 30

30. Ascospores almost homopolar, with the upper cell slightly wider and of more or less the same length as the lower one, readily splitting into semi-spores even in the asci. Lit.: Hawksworth (1990), present paper .... ***Abrothallus cladoniae***

30. Ascospores markedly heteropolar, with the upper cell much broader and up to 2.5 times longer than the lower one, only occasionally splitting into semi-spores. Lit.: Diederich (2003), present paper .... ***Abrothallus pezizicola***

29. Ascomata flat to somewhat concave 31

31. Ascospores 33–37 × 12–14 µm. Lit.: Alstrup & Olech (1993) .... ***Dactylospora cladoniicola* Alstrup & Olech**

31. Ascospores smaller 32

32. Ascospores mainly 1-septate 33

33. Ascomata usually with distinct stipe 40–100 µm tall; ascospores (0–)1-septate, hyaline or rarely light brown, (7.5–)10.5–13(–16.5) × (3–)3.5–4.5(–5.5) µm. Lit.: Pino-Bodas et al. (in press) .... ***Dactylospora ahtii* Zhurb. & Pino-Bodas ined.**

33. Ascomata only occasionally with a stipe up to 40 µm tall; ascospores (0–)1(–2)-septate, pale yellow-gray-olive-brown to medium brown, (9–)11–15(–18.5) × (3.5–)4.5–6(–7.5) µm. Lit.: Pino-Bodas et al. (in press) .... ***Dactylospora* sp.**

32. Ascospores mainly with more transsepta 34

34. Ascospores (3–)5–7(–8)-transseptate, rarely with additional oblique septum, (14–)17–21.5(–28) × (4–)4.5–6(–7) µm. Lit.: Triebel (1989), present paper .... **[*Dactylospora deminuta*]**

34. Ascospores (0–)3-septate, (9.5–)12.5–17.5(–19.5) × (4–)5–6(–7.5) µm. Lit.: present paper .... ***Dactylospora* sp.**

Key 3. Ascomycetes with perithecioid or sometimes catathecioid ascomata

1. Ascomata catathecioid 2

2. Ascomata without ostiolar setae. Lit.: Hansen & Alstrup (1995), present paper .... ***Lichenopeltella cladoniarum* (see also *Lichenopeltella* sp. in the catalogue)**

2. Ascomata with ostiolar setae 3

3. Ascomata 80–120 µm in diameter; asci 4(–8)-spored; ascospores (1–)3-septate, (13–)14–15.5(–16) × (3–)3.5–4 µm, with 3 pairs of setulae. Lit.: Brackel (2011) .... ***Lichenopeltella rangiferinae* Brackel**

3. Ascomata 40–85 µm in diameter; asci 4–8-spored; ascospores 1-septate, (11.5–)12–14.3(–15.5) × 3–3.4(–4.5) µm, without setulae. Lit.: Brackel (2010a), present paper .... ***Lichenopeltella uncialicola***

1. Ascomata perithecioid 4

4. Ascomata pale to moderately pigmented, almost white, reddish brown, red, pink, cream, orange, saffron or yellow 5

5. Asci usually with four microspores, (7–)8.5–11.5(–16.5) × (3.5–)4.5–5.5(–7) µm, and one macrospore, (18.5–)42.5–73(–86) × (7–)18.5–33.5(–40) µm. Lit.: Hawksworth & Booth (1976), Zhurbenko (2014) .... **[*Ovicuculispora parmeliae* (Berk. & M.A. Curtis) Etayo]**

5. Ascospores not dimorphic 6

6. Ascomata mostly immersed, protruding only in the ostiolar area 7

7. Ascospores (5–)6–8 × 2–3.5 µm. Lit.: Motiejūnaitė & Kukwa (2008) .... ***Pronectria minuta* Motiej. & Kukwa**

7. Ascospores longer than 8 µm 8

8. Ascospores (8–)10–13.5(–16) × (2.5–)3–4(–5) µm, verruculose. Lit.: Zhurbenko & Alstrup (2004), present paper .... ***Pronectria tibellii***
8. Ascospores (11–)12.5–17.5(–20) × (2.5–)3–3.5 µm, smooth-walled. Lit.: present paper .... ***Pronectria* sp.**

6. Ascomata superficial 9

9. Ascospores bicaudate, muriform 10

10. Asci 4-spored; ascospores (45–)54–75(–92) × (17–)23.5–32.5(–40) µm, becoming pale salmon to yellow brown at maturity. Lit.: Zhurbenko (2009c).............. .... **[*Paranectria alstrupii* Zhurb.]**
10. Asci 8-spored; ascospores (22–)25–32(–36) × (9–)11–14(–15) µm, consistently hyaline. Lit.: Hawksworth (1982) .... **[*Paranectria oropensis* (Ces.) D. Hawksw. & Piroz.]**

9. Ascospores without cauda, not muriform 11

11. Ascomata in the upper part with white, straight, aseptate hairs up to 100 µm long; ascospores not ellipsoid, up to 21-septate 12

12. Ascospores long fusiform, sometimes slightly curved, 26–30 × 3–5 µm, (0?–)1-septate. Lit.: Alstrup & Svane (1998) .... ***Trichonectria cladoniicola* (Alstrup & Svane) Alstrup**
12. Ascospores long fusiform, cylindrical, vermiform or sigmoid, 45–85 × 5–8 µm, 11–21-septate. Lit.: Rossman et al. 1999 .... **[*Trichonectria hirta* (A.Bloxam) Petch]**

11. Ascomata without such hairs or hairs shorter and septate; ascospores ellipsoid, 1-septate 13

13. Ascospores 6.5–8.5(–9.5) × 3.5–4.5(–5) µm. Lit.: Cole & Hawksworth (2001) .... ***Nectriopsis cladoniicola* M.S. Cole & D. Hawksw.**
13. Ascospores (9–)9.5–12.5(–15) × (3.5–)3.5–4.5(–5) µm. Lit.: Brackel & Zimmermann (2012) .... ***Nectriopsis cariosae* Brackel & D.G. Zimmermann**

4. Ascomata exclusively or mostly dark to black 14

14. Ascomata with a beak several times longer than its main body; asci with a wall soon disintegrating during spore maturation; ascospores paler at the ends, doliiform. Lit.: Etayo (2008) . ... ***Syspastospora cladoniae* Etayo**
14. Ascomata without a long beak; asci with persistent wall; ascospores not as above 15

15. Ascomata with setae or with projecting long brown septate hyphae 16

16. Ascomata with long, brown, septate projecting hyphae. Lit.: Matzer & Hafellner (1990), present paper .... ***Roselliniella cladoniae***
16. Ascomata with setae 17

17. Ascospores bicaudate. Lit.: present paper .... ***Biciliopsis cladoniae***
17. Ascospores without cauda 18

18. Ascospores medium to dark brown, discoid. Lit.: present paper .... **[*Coniochaeta* sp.]**
18. Ascospores hyaline or occasionally light brown, not discoid 19

19. Ascomata mainly 100–130 µm in diameter, superficial; setae usually more than 25 µm long, macroscopically always conspicuous, subulate, with acute apex; asci mostly subcylindrical, tholus with tiny marginal and central indentations; ascospores 1-septate, (6.5–)8.5–10.5(–13) × (1.5–)2–2.5(–3) µm. Lit.: Hawksworth (1975b), present paper .... ***Niesslia cladoniicola***
19. Ascomata mainly 50–80 µm in diameter, usually more or less immersed; setae usually up to 25 µm long, sometimes much reduced and macroscopically inconspicuous, more or less isodiametric, with rounded apex; asci clavate, obclavate or ellipsoid, tholus without marginal

indentation; ascospores 0(–1)-septate, (6.5–)9–12.5(–15) × (2–)3–4(–5) µm. Lit.: present paper .... ***Niesslia keissleri***

15. Ascomata without setae or projecting hyphae 20

20. Dark vegetative hyphae macroscopically clearly visible (× 10) and abundant 21

21. Vegetative hyphae often associated with brown, branched, flexuous, crest-like superficial stripes 40–80 µm wide, occasionally fusing in wider irregular patches; ascomata 25–35(–50) µm in diameter, superficial. Lit.: Hansen & Alstrup (1995), present paper .... ***Sphaerellothecium cladoniicola***

21. Vegetative hyphae not associated with such stripes; ascomata (25–)45–60(–70) µm in diameter, immersed to superficial. Lit.: Zhurbenko & Alstrup (2004) .... ***Sphaerellothecium cladoniae***

20. Dark vegetative hyphae macroscopically inconspicuous (× 10) 22

22. Ascospores hyaline 23

23. Ascospores ca. 165–175 × 1 µm, filamentous. Lit.: Candoussau et. al. (2007) ....**[*Neobarya lichenophila* (Ferd. & Winge) Lowen & Samuels]**

23. Ascospores up to 35 µm long, not filamentous 24

24. Ascomata gelatinous, glossy; asci dehiscing by longitudinal splits, with wall entirely I and K/I+ blue. Note: the species of *Epigloea* presented below are rather algicolous, associated with algal films overgrowing various substrates including lichens 25

25. Asci 8-spored; ascospores ellipsoid, oblong or somewhat sole or shoe-like, with rounded ends, (0–)1-septate, (8–)9.5–12.5(–15) × (3.5–)4–5(–7) µm. Lit.: Döbbeler (1984), Zhurbenko (2010a) .... **[*Epigloea soleiformis*]**

25. Asci up to 50-spored; ascospores bacilliform with rounded ends or occasionally fusiform with acute ends, 1-septate, (6–)7–10(–11.5) × 1.5(–2) µm. Lit.: Döbbeler (1984) .... **[*Epigloea bactrospora* Zukal]**

24. Without such combination of characters 26

26. Asci (8–)16-spored. Lit.: present paper .... ***Neolamya ahtii***

26. Asci up to 8-spored 27

27. Interascal filaments absent 28

28. Asci 30–48 × 10–17 µm; ascospores (9–)11.5–14.5(–16.5) × (3–)3.5–4(–5) µm. Lit.: Zhurbenko & Diederich (2008), present paper .... ***Stigmidium cladoniicola***

28. Asci 17–25 × 7–9 µm; ascospores (6–)6.5–7 × 2–2.5 µm. Lit.: Van den Boom (2016) .... ***Stigmidium subcladoniicola*** **van den Boom**

27. Interascal filaments present 29

29. Interascal filaments sparsely branched 30

30. Apical part of the ascal wall K/I (Melzer)+ blue; ascospores 3-septate, 13–14 × 5–5.5 µm. Lit.: Alstrup & Olech (1993) . ***Stellifraga cladoniicola*** **Alstrup & Olech**

30. Asci K/I–; if ascospores 3-septate, then longer 31

31. Ascospores (0–)1-septate, (12–)13–16.5(–19) × (3.5–)4.5–5.5(–6) µm; exciple purplish brown. Lit.: Zhurbenko & Vershinina (2014) .... ***Cercidospora* sp.**

31. Most ascospores with more than one septum, exciple only rarely purplish brown 32

32. Ascospores (0–)1–3-septate, (11–)13.5–17.5(–22) × (2.5–)4–5(–6) µm; exciple mainly olive to brown, sometimes partly reddish purple brown, grayish olive or blue-green. Lit.: Alstrup (1997), present paper .... ***Cercidospora cladoniicola***

32. Ascospores (1–)3–5(–6)-septate, (14–)18.5–25(–33) × (4–)4.5–6(–9) µm; exciple emerald to glaucous green. Lit.: Hafellner (1987), Zhurbenko (2012a), Zhurbenko & Triebel (2003) .... **[*Cercidospora punctillata* (Nyl.) R. Sant.]**

29. Interascal filaments densely branched and anastomosed 33

33. Asci I+ blue, ascospores muriform 34

34. Distinctly lichenized. Note: the species mainly grows over bryophytes and only occasionally on lichens. Lit.: Mayrhofer & Poelt (1985) .... **[*Protothelenella leucothelia*]**

34. Not lichenized or occasionally indistinctly lichenized 35

35. Lichenized thallus absent; ascospores with (0–)3–5(–7) transversal or oblique septa and usually 1 longiseptum in central segments, (14.5–)19.5–26(–31.5) × (6–)8.5–11.5(–16) µm. Lit.: Mayrhofer (1987), Zhurbenko & Alstrup (2004), present paper .... ***Protothelenella santessonii***

35. Lichenized thallus absent or membrane-like; ascospores with up to 10 transversal or oblique septa and 1 longiseptum in central segments, (22–)24.5–29(–33) × 6.5–7.5(–10) µm. Note: the species mainly grows over bryophytes and only occasionally on lichens. Lit.: Mayrhofer & Poelt (1985), Zhurbenko & Alstrup (2004) .... **[*Protothelenella sphinctrinoidella* (Nyl.) H. Mayrhofer & Poelt]**

33. Asci I–, ascospores 1-septate 36

36. Ascomata 75–180 µm in diameter; ascospores narrowly obovoid with a somewhat wider upper cell, (8–)9.5–12.5(–15) × (2.5–)3–4(–4.5) µm. Lit.: Aptroot et al. (1997), present paper .... ***Zwackhiomyces diederichii***

36. Ascomata 300–425 µm in diameter; ascospores broadly fusiform, apices generally somewhat pointed, 12–19 × 3–5 µm. Note: known only from the type in the Subantarctic. Lit.: Hawksworth & Itturiaga (2006) .... ***Zwackhiomyces cladoniae* (C.W. Dodge) Diederich**

22. Ascospores pigmented 37

37. Interascal filaments present 38

38. Ascospores submuriform with 3 transsepta and 1(–2) longisepta in central segments. Lit.: Halici et al. (2008) .... ***Dacampia cladoniicola*** **Halici & A.Ö. Türk**

38. Ascospores transseptate 39

39. Ascomatal wall partly blue-green/green near ostiole; ascospores (19–)21.5–25.5(–28) × (8.5–)9–11(–11.5) µm, (1–)3-septate, sometimes with paler end cells. Lit.: Navarro-Rosinés & Roux (2007), present paper .... **[*Pyrenidium actinellum* s. lat.]**

39. Ascomatal wall without blue-green/green parts; ascospores smaller, mainly with fewer than 3 septa, with concolorous end cells 40

40. Ascospores (6.5–)8.5–10.5(–14) × (3–)3.5–4.5(–5.5) µm, (0–)1(–3)-septate. Note: *Polycoccum laursenii* might be a heterotypic synonym of *Didymocyrtis consimilis* Vain. (Ertz et al. 2015). Lit.: Zhurbenko & Alstrup (2004), present paper .... ***Polycoccum laursenii***

40. Ascospores mainly longer than 11 µm 41

41. Ascomata more or less superficial at maturity. Lit.: Hawksworth & Diederich (1988) .... ***Polycoccum cladoniae*** **Diederich & D. Hawksw.**

41. Ascomata immersed to slightly protruding 42

42. Ascomata 100–130 µm in diameter, with a neck 40–70 µm tall, scattered; ascospores 16.5–24(–28) × 4.5–5.5(–6) µm, (1–)3-septate. Lit.: present paper .... ***Leptosphaeria*** **sp.**

42. Ascomata 30–70(–120) µm in diameter, without distinct neck, aggregated in groups; ascospores (12–)13–15(–17) × (4.5–)5–6(–7.5) µm, 1(–2)-septate. Lit.: Etayo & Diederich (1998), Flakus et al. (2008), present paper .... ***Polycoccum microcarpum***

37. Interascal filaments absent 43

43. Hymenial gel I–; ascospores 9–11.5 × 3–4 µm, 1(–3)-transseptate. Lit.: Etayo & Diederich (1998) .... ***Sphaerellothecium cinerascens*** **Etayo & Diederich**

43. Hymenial gel I+ red; ascospores larger, with transversal and at least rarely with longitudinal septa 44

44. Ascospores (16.5–)20–24.5(–28.5) × (5.5–)7.5–9.5(–10.5) µm, muriform, with 3–8 transsepta and 1(–2) longitudinal or oblique septa in most segments. Lit. Triebel (1989), present paper .... **[*Merismatium* cf. *nigritellum*]**

44. Ascospores smaller, if submuriform, then with less number of transsepta 45

45. Ascospores usually just transseptate, with (0–)1–3(–4) transsepta, rarely with 1(–2) longitudinal or oblique septa in central segments, (9.5–)11.5–14.5(–16.5) × (3.5–)4–5.5(–7) µm. Lit.: Alstrup (1997), Triebel (1989), Zhurbenko & Kobzeva (2014), present paper .... **[*Merismatium decolorans* (? syn. *Merismatium cladoniicola*)]**

45. Ascospores often submuriform, with longitudinal septa in central segments 46

46. Ascospores (10.5–)12.5–17(–21) × (6–)7–8.5(–12) µm, with 2–6 trans- or oblique septa and 0–3 longisepta in central segments. Lit.: Triebel (1989), present paper .... **[*Merismatium coccisporum*]**

46. Ascospores generally smaller 47

47. Ascospores (8–)10–13(–16) × (4–)5–6.5(–7.5) µm, with 3–4 transsepta and sometimes 1–2 longisepta. Lit. Triebel (1989) .... **[*Merismatium heterophractum* (Nyl.) Vouaux]**

47. Ascospores 10.5–14.5 × 5.5–7 µm, with 3 transsepta and sometimes 1–2 longisepta in central segments. Lit.: Etayo & Sancho (2008) .... **[*Merismatium coccotremicola* Etayo]**

Key 4. Coelomycetes

1. Conidiomata stromatic 2

2. Conidia mainly 10–15 × 8.5–11 µm in diameter, composed of 8–17 cells (in optical section 6–10 cells) Lit.: Ertz et al. (2014) .... **[*Lichenostigma alpinum* s. lat.]**

2. Conidia mainly 14–23 × 10–16 µm in diameter, composed of 14–35 cells (in optical section 10–21 cells) Lit.: Ertz et al. (2014) .... [***Lichenostigma maureri*]**

1. Conidiomata not stromatic 3

3. Conidiomata pycnidioid to sporodochioid (particularly at later stages) 4

4. Conidia very light to medium bluish green, angular subglobose, occasionally oblong or ovoid, aseptate. Lit.: present paper .... ***Caeruleoconidia biazrovii***

4. Conidia not bluish green, bacilliform to filiform, septate 5

5. Conidia mainly 3–6-septate, mainly 35–71 µm long. Lit.: Diederich & Van den Boom (2013), present paper .... ***Hainesia longicladoniae***

5. Conidia mainly 1-septate, shorter 6

6. Conidia mainly 12–16 µm long. Lit.: Diederich & Van den Boom (2013), present paper .... ***Hainesia brevicladoniae***

6. Conidia mainly 17–25 µm long. Lit.: Zhurbenko & Brackel (2013), present paper .... **[*Hainesia* cf. *bryonorae*]**

3. Conidiomata never sporodochioid 7

7. Mature conidiomata containing spherical, elongate ellipsoid or obpyriform, (1–)2–4(–5)-celled macroconidia and subcylindrical, 1-celled microconidia. Lit.: Diederich & Sérusiaux (2003) .... ***Stromatopogon cladoniae* Diederich & Sérus.**

7. Conidiomata always with one kind of conidia 8

8. Conidiophores mainly composed of more than one cell; conidia hyaline, aseptate 9

9. Conidia reniform, lacriform, sometimes ellipsoid or oblong. Lit. Hawksworth (1981), present paper .... ***Lichenosticta alcicorniaria***

9. Conidia Y-shaped 10

10. Main conidial axis (from the truncate base to the point at the apex where the conidium bifurcates) usually 6–11.5 × 1.5–2 µm, divergent apical arms gradually tapered. Lit.: Hawksworth (1976) **[*Cornutispora lichenicola* D. Hawksw. & Sutton]**

10. Main conidial axis usually 6.5–9 × 2–2.5 µm, divergent apical arms with bulbous bases and very narrow tubular apices. Lit.: Gierl & Kalb (1993), Punithalingam (2003) .... **[*Cornutispora ciliata* Kalb]**

8. Conidiophores mainly composed of one conidiogenous cell; conidia hyaline or pigmented, aseptate or septate 11

11. Conidia hyaline or (very rarely in *Epicladonia sandstedei*) light brown 12

12. Filiform paraphyses developing between the conidiogenous cells present; conidia with a minuscule apiculus bearing 2–3 divergent extracellular appendages. Lit.: Brackel (2009), Van den Boom et al. (1998) **[*Pseudorobillarda peltigerae* Diederich]**

12. Paraphyses absent; conidia without such appendages 13

13. Conidia often appearing H-shaped, with four cylindrical arms. Lit.: Diederich et al. (2001) .... ***Cladoniicola staurospora* Diederich, Van den Boom & Aptroot**

13. Conidia without arms 14

14. Conidiogenous cells with 1–3 phialides. Lit.: Hawksworth (1981), Kocourková (2000) .... ***Keissleriomyces sandstedeanus* (Keissler) D. Hawksw.**

14. Conidiogenous cells not polyphialidic 15

15. Conidia mostly lens-shaped, occasionally obpyriform or limoniform. Lit.: Hawksworth (1981), present paper .... ***Bachmanniomyces uncialicola***

15. Conidia not lens-shaped 16

16. Pycnidial wall K+ olivaceous; conidia usually slightly curved. Lit.: Diederich et al. (2012b) .... **[*Briancoppinsia cytospora* (Vouaux) Diederich, Ertz, Lawrey & van den Boom]**

16. Pycnidial wall not K+ olivaceous; conidia usually straight ... 17

17. Pycnidial wall of *textura intricata*; conidiogenous cells annellate; conidia rounded at the apex and truncated at the base by a scar, usually not biguttulate 18

18. Conidia (0–)1-septate; usually inducing distinct galls. Lit.: Hawksworth (1981), present paper .... ***Epicladonia sandstedei***

18. Conidia exclusively or mainly aseptate; distinct galls absent 19

19. Conidia mainly narrower than 3 µm, (6.5–)7.5–8.5(–9.5) × (2–)2.5–3(–3.5) µm, fusiform to occasionally almost oblong, aseptate; pycnidial wall partly blue-green or olivaceous green. Lit.: Hawksworth (1981), Ihlen & Wedin (2006), present paper .... ***Epicladonia simplex***

19. Conidia mainly broader than 3 µm, (5.5–)7–9(–14.5) × (2.5–)3–4(–4.5) µm, narrowly ellipsoid, oblong or slightly narrowly ovoid, occasionally rather irregular in shape, aseptate or in some specimens up to 10% 1-septate; pycnidial wall not blue-green or olivaceous green. Lit.: Hawksworth (1981), Sérusiaux et al. (2003), present paper .... ***Epicladonia stenospora* s. lat.**

17. Pycnidial wall of *textura angularis*; conidiogenous cells not annellate; conidia rounded at both ends, usually biguttulate 20

20. Conidia 4–5 × 1 µm. Lit.: Etayo (1996b), Hawksworth (1981) .... **[*Phoma lichenis* Pass.]**

20. Conidia broader 21

21. Conidia mainly 4–5 × 1.5–2 µm. Lit.: Diederich et al. (2007) .... ***Phoma grumantiana***

21. Conidia broader 22

22. Conidia (3.5–)4–4.5 × 2.5–3 µm. Lit.: Ertz et al. (2015) .... **[*Didymocyrtis consimilis* Vain. s. lat., population on *Cladonia pocillum*]**

22. Conidia longer 23

23. Conidia broadly ellipsoid, mainly 4.5–6 × 2.5–3 µm, l/b = 1.7–2.2. Lit.: Diederich et al. (2007), Ertz et al. (2015) .... **[*Didymocyrtis cladoniicola*]**

23. Conidia elongate ellipsoid, mainly 5.5–7 × 2–2.5 µm, l/b = 2.3–3.0. Lit.: Diederich et al. (2007), present paper .... **[*Didymocyrtis foliaceiphila*]**

11. Conidia pigmented 24

24. Pycnidial wall partly greenish brown and dark bluish, K+ aeruginose. Lit.: Lawrey et al. (2011) .... ***Lichenoconium aeruginosum***

24. Pycnidial wall brown throughout, K+ olivaceous 25

25. Pycnidia mainly 30−50 µm in diameter; conidiogenous cells mainly up to 5 µm tall; strong pathogen. Lit.: Hawksworth (1977) .. **[*Lichenoconium erodens*]**

25. Pycnidia more than 50 µm in diameter; conidiogenous cells mainly more than 5 µm tall; weak pathogen 26

26. Conidia mainly 2.5–3.5 × 2–2.5 µm, light to sometimes medium yellowish brown or occasionally subhyaline, pale in mass, usually indistinctly verruculose, often obovoid, attenuated and truncated at the base. Lit.: Hawksworth (1977), Lawrey et al. (2011), present paper........................ ....**[*Lichenoconium pyxidatae*]**

26. Conidia mainly 3.5–4 × 2.5–3.5 µm, light to mainly medium brown, usually distinctly verruculose, only occasionally obovoid, attenuated and truncated at the base. Lit.: Hawksworth (1977), Lawrey et al. (2011), present paper .... **[*Lichenoconium usneae*]**

Key 5. Hyphomycetes

1. Conidiophores 15–25(–45) µm long, bearing above a cluster of conidiogenous cells that are initially enclosed in a hyaline, subspherical, membranous enveloping sheath 20–40 µm in diameter, finally disappearing. Lit.: Hawksworth & Etayo (2010) .... **[*Calongeomyces gibelluloides* (D. Hawksw. & Etayo) D. Hawksw. & Etayo]**

1. Conidiogenous cells and conidia never enclosed in an enveloping sheath 2

2. Conidiophores at least sometimes sporodochioid (particularly at later stages) 3

3. Conidiomata pycnidioid to sporodochioid 4

4. Conidia very light to medium bluish green, angular subglobose, occasionally oblong or ovoid, aseptate. Lit.: present paper .... ***Caeruleoconidia biazrovii***

4. Conidia not bluish green, bacilliform to filiform, septate 5

5. Conidia mainly 3–6-septate, mainly 35–71 µm long. Lit.: Diederich & Van den Boom (2013), present paper .... ***Hainesia longicladoniae***

5. Conidia mainly 1-septate, shorter 6

6. Conidia mainly 12–16 µm long. Lit.: Diederich & Van den Boom (2013), present paper .... ***Hainesia brevicladoniae***

6. Conidia mainly 17−25 µm long. Lit.: Zhurbenko & Brackel (2013), present paper . ... **[*Hainesia* cf. *bryonorae*]**

3. Conidiomata constantly sporodochioid 7

7. Conidia with unevenly thickened wall with darker thickenings. Lit.: Etayo & Diederich (1996) .... ***Milospium lacoizquetae* Etayo & Diederich**
7. Conidia with evenly thickened and evenly pigmented wall 8

8. Conidia olive gray, with wall 1–2 µm thick. Lit.: present paper .... ***Sclerococcum crassitunicatum***
8. Conidia brown, with wall up to 1 µm thick 9

9. Conidia (5.5–)7–18.5(–30) × (3.5–)5.5–13.5(–23.5) µm, ca. 2–50-celled. Lit.: present paper .... ***Sclerococcum epicladonia***
9. Conidia smaller, 1- or occasionally 2-celled 10

10. Sporodochia 7–20(–30) µm in diameter; conidia aseptate, 2.2–3 µm in diameter, smooth-walled, adhering in indistinct chains. Lit.: Diederich (2010), Diederich et al. (2013) .... ***Cladophialophora cladoniae***
10. Sporodochia (37–)49–79(–97) µm in diameter; conidia 0(–1)-septate, (3–)4–5(–5.5) × (3–)3.5–4.5(–5) µm (aseptate) or 5.5–7 × 3.5–5 (1-septate), with indistinctly verruculose wall, not adhering in chains. Lit.: present paper .... ***Cladophialophora* cf. *cladoniae***

2. Conidiophores never sporodochioid 11

11. Conidia hyaline 12

12. Colonies very inconspicuous; conidiophores protruding, pale bown, 20–47 µm long, 1–3-septate, ending at the top by a lageniform phialide gradually narrowing to a deep cylindrical collarette 1.5–2 µm wide; conidia cylindrical with truncate ends, aseptate, 2.5–4 × 0.5–0.8 µm. Lit.: Christiansen (1993) .... ***Chalara lichenicola* M.S. Christ.**
12. Species with a different combination of characters; conidia larger 13

13. Conidia 0–1-septate. Lit.: Hawksworth (1979), present paper .... **[*Acremonium lichenicola* W. Gams, see *Acremonium* sp. 2 in the catalogue above]**
13. Conidia aseptate 14

14. Conidia (4–)4.5–5.5(–6.5) × 2–2.5(–3) µm, oblong. Note: possibly not truly lichenicolous. Lit.: present paper .... **[*Acremonium* sp. 1]**
14. Conidia 12–18 × 2–2.5 µm, elongate-cylindrical. Lit.: Hawksworth (1979) ... **[*Trichonectria rubefaciens* (Ellis & Everh.) Diederich & Schroers. anamorph, syn. *Acremonium rhabdosporum* W. Gams]**

11. Conidia pigmented 15

15. Conidiophores immersed in the host tissues; conidia pale brown, subspherical to ellipsoid, 3–4.5 × 2.5–4 µm, 0(–1)-septate, in chains composed of up to 20 conidia. Lit.: Diederich (1990), Hawksworth & Cole (2002) .... **[*Intralichen lichenum* (Diederich) D. Hawksw. & M.S. Cole]**
15. Conidiophores superficial; conidia different 16

16. Conidia in a well-defined head at the apex of the stipe 17

17. Conidiophores aggregated in synnemata; conidia cuneiform, 7.5 × 3.5–4 µm, smooth. Lit.: Alstrup & Hawksworth 1990, Diederich et al. (2012a) .... **[*Graphium aphthosae* Alstrup & D. Hawksw.]**
17. Conidiophores not aggregated in synnemata; conidia spherical, 7–11 µm in diameter, verruculose to shortly echinulate. Note: the species mainly grows on dead herbaceous plants and only occasionally on lichens. Lit.: Ellis (1971) .... **[*Periconia digitata* (Cooke) Sacc.]**

16. Conidia not in a well-defined head at the apex of the stipe 18

18. Conidiogenous cells polyblastic 19

19. Conidia (0–)3-septate, 9–14 × 3–4 µm. Lit.: Hawksworth (1979) .... **[*Pseudocercospora lichenum* (Keissl.) D. Hawksw.]**
19. Conidia 0–2(–3)-septate 20

20. Conidia aseptate, 2–5(–7) × 2–3.5(–4) µm, broadly obovoid, occasionally subglobose, apex rounded, base rounded to somewhat attenuated, with rather inconspicuous basal hilum, arising singly; conidiogenous loci and hila not coronate. Lit.: Braun et al. (2009) .... ***Ramichloridium cladoniicola* U. Braun & Heuchert**

20. Conidia 0–2(–3)-septate, 3.5–16 × 3–8 µm, subglobose, limoniform to ellipsoid-subcylindrical, ends rounded to slightly attenuated, with a single basal and 1–4 terminal hila, arising in branched acropetal chains; conidiogenous loci and hila coronate (with convex central dome surrounded by a raised rim). Lit.: Brackel (2009), Heuchert & Braun (2006) .... **[*Cladosporium licheniphilum* Heuchert & U. Braun]**

18. Conidiogenous cells monoblastic 21

21. Conidiogenous cells percurrently proliferating 22

22. Secession schizolytic; conidia smooth-walled to often verruculose. Lit.: Diederich (1992), Zhurbenko & Braun (2013), present paper .... ***Taeniolella beschiana***

22. Secession rhexolytic; conidia consistently smooth-walled 23

23. Conidiophores (70–)95–235(–250) µm long; conidia 11–21 × 5.5–10 µm, often minutely apiculate, (0–)1-septate, thin-walled, light brown, apical and basal cells more or less similar, basal cell mostly not collapsing. Lit.: Zhurbenko et al. (2015b) .... ***Endophragmiella stordeuriana***

23. Conidiophores (57–)66–107(–125) µm long; conidia (12.5–)15–16(–17.5) × (5–)6–7.5(–8.5) µm, non-apiculate, 1(–2)-septate, the apical cell brown to dark brown, thick-walled, 1.5–2 times larger than the basal cell, which is light brown to subhyaline, thin-walled, much smaller and often collapsed. Lit.: Brackel & Markovskaja (2009), Zhurbenko et al. (2015b) ....**[*Endophragmiella franconica* Brackel & Markovsk.]**

21. Conidiogenous cells not proliferating 24

24. Mycelium developing inside host's hyphae; conidia 0(–1)-septate, 7–8 × 3.5–4 µm (aseptate) or 11–14 × 3.5–4.5 µm (1-septate). Lit.: Alstrup (1993b) .... ***Taeniolella cladinicola* Alstrup**

24. Intracellular mycelium absent; conidia 1–2-septate, 8.5–12 × 5.5–6 µm. Lit.: Zhurbenko & Alstrup (2004) .... ***Taeniolella strictae* Alstrup**

DISCUSSION

Together with *Lecanora* s. lat., *Peltigera* and *Pseudocyphellaria*, *Cladonia* is one of the most 'hospitable' lichen genera for lichenicolous fungi (Lawrey & Diederich 2016). The key presented above includes 138 species of fungi known to occur on *Cladonia* worldwide, 128 (93% of the total number) of which are obligately lichenicolous, and 89 (64%) are known exclusively from this host genus. The ratio of 'host species to lichenicolous fungi species' for *Cladonia* is approximately 3.7. The species found on *Cladonia* that are not exclusively lichenicolous are *Anzina carneonivea*, *Coniochaeta* sp., *Epigloea soleiformis*, *E. bactrospora*, *Periconia digitata*, *Protothelenella leucothelia*, *P. sphinctrinoidella* and possibly *Acremonium* sp. 1. *Diploschistes muscorum* is an obligate juvenile parasite of lichens. Most of the species (95%) included in the key are non-lichenized, while *D. muscorum* and *P. leucothelia* produce a well-developed lichenized thallus (at least at later stages), and *A. carneonivea*, *Chaenothecopsis vinosa* and *P. sphinctrinoidella* are scarcely lichenized. *Epigloea bactrospora*, *E. soleiformis* and possibly *Graphium aphthosae* can be considered as algicolous species. Of the 128 species of lichenicolous fungi, seven (5% of the total number) are basidiomycetes and 121 (95%) are ascomycetes, of which 46 (36%) are represented by anamorphs.

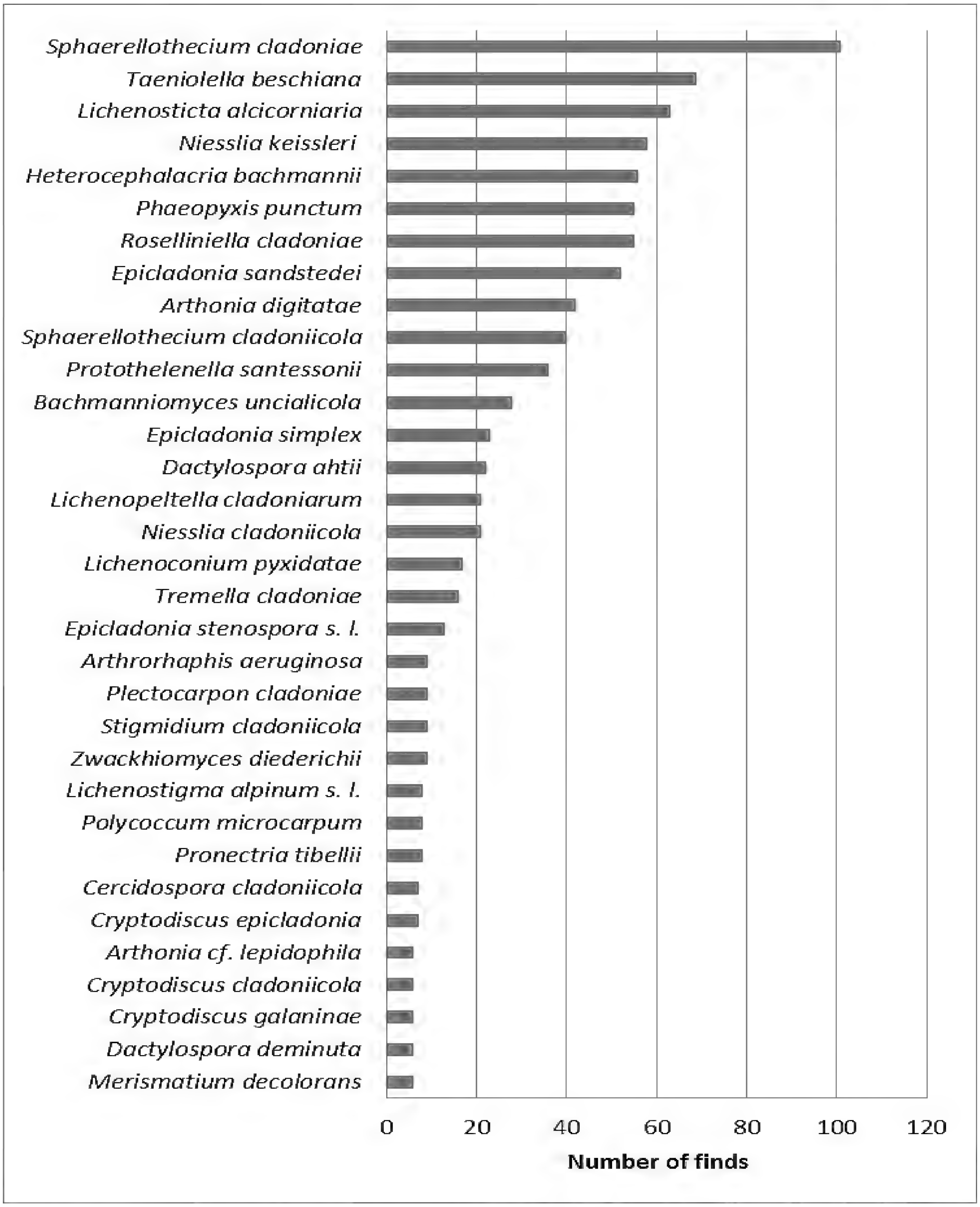

Figure 15. The most common lichenicolous fungi growing on *Cladonia* in the arctic and boreal regions of the Northern Hemisphere.

The actual diversity of lichenicolous fungi growing on *Cladonia* is expected to be much higher than summarized here. It is noteworthy that about 28% of cladoniicolous fungi have been recognized or described in the past 12 years. About 100 specimens examined by us could not be assigned to a given taxon with certainty and had to be left unnamed. These were not included in the synoptic key. Among these are numerous specimens with sterile dark green spots on basal squamules and occasionally podetia of various *Cladonia* species, many specimens of heterobasidiomycetes with morphological characters that are difficult to observe, a *Trimmatostroma*-like hyphomycete, a hyphomycete associated with *Roselliniella cladoniae* (Figure 10), a coelomycete with bacilliform (0–)1(–3)-transseptate conidia briefly described and illustrated above (Figure 14), and pycnidia associated with *Phaeopyxis punctum* (see notes under that species). Additionally, there are a number of reports of fungi from *Cladonia* species pending revision that were also not included in the key. These include *Arthonia* cf. *molendoi* (Frauenf.) R. Sant. (Alstrup & Hawksworth 1990), *A. pelvetii* (Hepp) H. Olivier (Alstrup & Hawksworth 1990), *Galloea cladoniicola* Alstrup & Søchting (Alstrup & Søchting 2009, Seifert et al 2011), *Hypoxylon lichenicolum* Höhn. (Höhnel 1927), *Lichenopeltella* sp. (Aptroot et al. 1997: 86–87), a species of *Lichenostigma* subgen. *Lichenogramma* (Zhurbenko & Brackel 2013), *Llimoniella groenlandiae* (Alstrup & D. Hawksw.) Triebel & Hafellner (Alstrup 1991), a *Monocillium* state of *Niesslia cladoniicola* (Hawksworth 1979), *Physalospora cladoniae* (Stein) Vouaux (Hoffmann & Hafellner 2000, Roux & Gueidan 2002), *Pseudocercospora lichenum* (Keissl.) D. Hawksw. (Hawksworth 1979), *Sclerococcum* sp. (Spribille et al. 2010), *Scutula cladoniarum* (Müll. Arg.) Rambold & Triebel ined. (Alstrup & Hawksworth 1990, Rambold & Triebel 1992), *Spilomium epicladonia* H. Olivier (Diederich & Sérusiaux 2003), *Stigmidium* sp. 1 (Brackel 2015), *Verrucaster lichenicola* Tobler (Hawksworth 1981), *Vouauxiomyces* sp. 1 (Etayo & Sancho 2008) and *Zwackhiomyces dispersus* (Körb.) Triebel & Grube (Alstrup & Hawksworth 1990).

Seven of the 65 species (11% of the total number) of obligately lichenicolous fungi documented herein are described as new to science. For comparison, similar revisions of lichenicolous fungi found on the macrolichen genera *Stereocaulon* and *Thamnolia* revealed 14% and 30% of new species respectively (Zhurbenko 2010a, 2012a).

The most common lichenicolous fungi that grow on *Cladonia* in the comparatively well-studied arctic and boreal regions of the Holarctic are presented in Figure 15. Their frequency was estimated based on 1095 occurrences of which 614 were documented in the present paper and 481 were compiled from the literature (Alstrup 1993a, 1997, 2004; Alstrup & Ahti 2007; Alstrup & Cole 1998; Alstrup & Hawksworth 1990; Alstrup & Olech 1993; Alstrup et al. 2000, 2005, 2008, 2009; Berger 2000; Brackel 2010a, 2011; Christiansen 1993; Diederich 1996, 2003; Diederich et al. 2007; Dillman et al. 2012; Ertz et al. 2005; Etayo & Breuss 1998; Hansen & Alstrup 1995; Hawksworth 1981; Heiðmarsson et al. 2012; Himelbrant et al. 2013; Ihlen & Wedin 2005, 2006; Matzer & Hafellner 1990; Motiejūnaitė & Kukwa 2008; Pippola & Kotiranta 2008; Rambold & Triebel 1990; Spribille et al. 2010; Stepanchikova & Himelbrant 2011; Titov 2006; Zhurbenko 1998, 2001, 2004, 2008, 2009a, 2009b, 2012b, 2013; Zhurbenko & Alstrup 2004; Zhurbenko & Brackel 2013; Zhurbenko & Braun 2013; Zhurbenko & Davydov 2000; Zhurbenko & Diederich 2008; Zhurbenko & Dillman 2010; Zhurbenko & Hafellner 1999; Zhurbenko & Himelbrant 2002; Zhurbenko & Laursen 2003; Zhurbenko & Pospelova 2001; Zhurbenko & Santesson 1996; Zhurbenko & Vershinina 2014; Zhurbenko & Yakovchenko 2014; Zhurbenko & Zhdanov 2013; Zhurbenko & Zheludeva 2015; Zhurbenko et al. 2005, 2012a, 2012b, 2015b).

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Lichenicolous fungi of the Caucasus: New species, new records and a second synopsis

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ABSTRACT. – Ninety-four species of lichenicolous and allied fungi are reported from the Northwest Caucasus. *Nanostictis caucasica* on *Parmelia sulcata* is described as new to science. A presumably new ascomycete with hairy apothecia growing on *Thamnolia vermicularis* is described but not given a formal name. *Acremonium pertusariae*, *Arthonia destruens*, *Cercidospora* cf. *rinodinae*, *Endococcus sendtneri*, *Lichenochora inconspicua*, *Lichenodiplis anomala*, *Rhizocarpon* cf. *ochrolechiae*, *Roselliniopsis tartaricola* and *Thelocarpon* cf. *sphaerosporum* are newly reported for Asia and Russia, *Polycoccum hymeniicola* is newly reported for Russia. A first verified occurrence of *Dactylospora tegularum* in Russia is reported. *Dactylospora athallina* and *Zwackhiomyces kiszkianus* are reported new to Asian Russia. *Cercidospora verrucosaria*, *Cornutispora ciliata*, *C. lichenicola*, *Dacampia hookeri*, *D. rufescentis*, *Didymocyrtis consimilis*, *Lichenochora caloplacae*, *Lichenostigma chlaroterae*, *Merismatium nigritellum* agg., *Monodictys fuliginosa*, *Pronectria erythrinella* s. l., *Scutula epiblastematica*, *Sphaerellothecium araneosum*, *Sphinctrina leucopoda*, *Stigmidium pseudopeltideae*, *S. squamariae* and *Tetramelas phaeophysciae* are reported new to the Caucasus. *Lichenochora caloplacae* is reported for the first time from outside the Arctic. An unusual intrahymenial parasite of *Lecanora pulicaris* similar to *Rhabdospora lecanorae* is discussed. *Bryoplaca* is reported as a new host genus for *Merismatium nigritellum* agg., *Cetrelia* for *Cornutispora lichenicola* and *Echinothecium reticulatum*, *Flavoparmelia* for *Cornutispora ciliata*, and *Pseudevernia* for *Lichenoconium cargillianum*. A synopsis of 248 species from 98 genera of lichenicolous fungi and three species from two additional genera of allied fungi so far known from the Caucasus is presented and analyzed. The most species-rich genera are *Stigmidium*, *Arthonia* and *Abrothallus*. 81% of the lichenicolous fungi species were found on only one host genus. The value of the 'parasite genera:host genera' ratio is about 1:1. The most frequently parasitized lichen genera are *Lecanora* s. l., *Parmelia*, *Peltigera*, *Cladonia* and *Physcia*. About half of the species found in the Caucasus occur outside the Holarctic. The lichenicolous index for the Russian Caucasus is approximately 0.2. The most frequently collected species were *Lichenostigma maureri*, *Marchandiomyces corallinus*, *Lichenoconium erodens*, *L. lecanorae* and *Nesolechia oxyspora*. About 25% of the detected species were considered visible to the naked eye, 60% were clearly visible only at 10× magnification, and 15% only at 20−40× magnification.

KEYWORDS. – Lichenicolous mycobiota, biodiversity, biogeography, ecology.

INTRODUCTION

The first publications that presented information about the lichenicolous fungi of the Caucasus appeared more than a century ago (Elenkin & Woronichin 1908, Vainio 1899). However, the systematic investigation of these organisms in the region began only recently. The first synopsis of lichenicolous fungi of the Caucasus included 72 species from 47 genera (Zhurbenko & Otte 2012). Subsequently, dedicated studies of these fungi in the Teberda and Caucasian Biosphere Reserves supported by the Russian Foundation for Basic Research were carried out (Zhurbenko & Kobzeva 2014, 2016; Zhurbenko & Pino-Bodas 2017; Zhurbenko et al. 2015b, c; present paper). These studies, along with additional new reports

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published in a series of lichen floristic contributions (Urbanavichene & Urbanavichus 2014; Urbanavichus & Ismailov 2013, 2016; Urbanavichus & Urbanavichene 2012, 2014, 2015a, b), increased their known diversity from the region by more than three times. Given the number of newly accumulated records, both published and unpublished, the present contribution was assembled with the goal of once again summarizing the lichenicolous mycobiota of the region.

MATERIALS AND METHODS

In addition to the published literature, this study is based on 232 specimens of lichenicolous fungi and lichenicolous lichens housed in the mycological herbarium of the V.L. Komarov Botanical Institute in St. Petersburg, Russia (LE). Microscopical examination was carried out using a Zeiss Axio Imager A1 microscope equipped with Nomarski differential interference contrast optics (DIC) in water, 10% KOH (K), Lugol's iodine, directly (I) or after a KOH pre-treatment (K/I), or brilliant cresyl blue (BCr). The length, breadth and length/breadth ratio (l/b) of asci, ascospores and conidia are given (where n > 10) as: (min−){X−SD}−{X+SD}(−max), where "min" and "max" are the extreme observed values, X the arithmetic mean and SD the corresponding standard deviation. Measurements were taken from water mounts, unless otherwise indicated.

Data for the twenty-two localities from which the newly reported specimens were collected is summarized below. The localities are referenced in the text by the number that appears in bold in the list below.

1: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, northeastern spur of Mt. Tybga, 43°52'48"N, 40°15'59"E, elev. 2480 m, alpine vegetation and siliceous rocks.

2: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, vicinity of Mt. Tybga, 1 km NE of Turovyi cabin, 43°54'03"N, 40°16'38"E, elev. 2040 m, *Betula litvinovii* forest.

3: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, Abago pastureland boundary, Mt. Ekspeditsiya, 43°54'48"N, 40°15'43"E, elev. 1950 m, *Pinus sylvestris* ssp. *kochiana* forest and siliceous rocks among mountain meadows.

4: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, Abago pastureland boundary, Mt. Ekspeditsiya, Dom Kotova cabin, 43°56'55"N, 40°12'31"E, elev. 1770 m, *Fagus orientalis-Abies nordmanniana-Acer trautphetteri* forest.

5: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, road between Guzeripl' settlement and Dom Kotova cabin, 43°58'27"N, 40°11'50"E, elev. 1400 m, *Abies nordmanniana* forest.

6: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, vicinity of Guzeripl' settlement, 44°00'05"N, 40°08'21"E, elev. 680 m, *Fagus orientalis-Carpinus betulus* forest.

7: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, vicinity of Guzeripl' settlement, near the junction of Filimonov Creek and Molchepa River, 43°59'25"N, 40°08'56"E, elev. 770 m, *Fagus orientalis-Abies nordmanniana* forest.

8: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, Belaya River 2 km upstream of Guzeripl' settlement, 43°59'21"N, 40°07'28"E, elev. 680 m, *Fagus orientalis-Abies nordmanniana* forest.

9: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, Lagonaki Upland, Azishskii pass, 44°04'33" N, 40°00'58" E, elev. 1750 m, mixed forest with *Abies nordmanniana*.

10: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, Lagonaki Upland, Armyanskii pass, 43°58'15"N, 39°56'30"E, elev. 1750 m, *Fagus orientalis* forest.

11: RUSSIA. REPUBLIC OF ADYGEYA: Caucasian Biosphere Reserve, headwaters of Armyanka River, 44°00'33"N, 39°59'42"E, elev. 1680 m, *Fagus orientalis-Abies nordmanniana* forest.

12: RUSSIA. KRASNODAR TERRITORY: Caucasian Biosphere Reserve, Lagonaki Upland, foot of Mt. Fisht at the headwaters of Belaya River, 43°57'34"N, 39°55'48"E, elev. 1580 m, *Abies nordmanniana-Betula litwinowii-Acer trautvetteri-Sorbus aucuparia* forest and calcareous rocks.

13: RUSSIA. KRASNODAR TERRITORY: Caucasian Biosphere Reserve, Lagonaki Upland, southeastern spur of Mt. Fisht, near Malyi Fishtinskii glacier, 43°57'08"N, 39°55'42"E, elev. 1640 m, *Abies nordmanniana-Betula litwinowii-Acer trautvetteri-Sorbus aucuparia* forest and calcareous rocks.

14: RUSSIA. KRASNODAR TERRITORY: Caucasian Biosphere Reserve, Lagonaki Upland, between Mt. Fisht and Mt. Pshekho-Su, 43°58'N, 39°54'E, elev. 2050–2300 m, alpine vegetation.

15: RUSSIA. KRASNODAR TERRITORY: Caucasian Biosphere Reserve, confluence of Urushten and Malaya Laba Rivers, Chernorech'e cabin, 43°55'59"N, 40°41'01"E, elev. 800 m, open rocks beside a road in *Fagus orientalis* dominated forest.

16: RUSSIA. KRASNODAR TERRITORY: Caucasian Biosphere Reserve, northern spur of Mt. Armovka, 43°54'N, 40°40'E, elev. 1150–1370 m, *Fagus orientalis* forest.

17: RUSSIA. KRASNODAR TERRITORY: Caucasian Biosphere Reserve, northern spur of Mt. Armovka, 43°53'59"N, 40°39'39"E, elev. 1750 m, mixed deciduous forest.

18: RUSSIA. KRASNODAR TERRITORY: Caucasian Biosphere Reserve, northern spur of Mt. Armovka, 43°53'27"N, 40°39'47"E, elev. 1830 m, *Betula litwinowii* forest.

19: RUSSIA. KRASNODAR TERRITORY: Caucasian Biosphere Reserve, northern spur of Mt. Armovka, 43°52'28"N, 40°39'20"E, elev. 2250 m, alpine vegetation and siliceous rocks.

20: RUSSIA. KRASNODAR TERRITORY: 1 km S of Dzhankhot settlement, top of Mt. Svyatoi Niny, 44°27'29–34"N, 38°09'32–49"E, elev. 180–330 m, *Quercus petraea-Pinus brutia* var. *pityusa* forest.

21: RUSSIA. KRASNODAR TERRITORY: 15 km SE of Gelendzhik, Zhane River valley, 44°33'N, 38°15'E, elev. 130–170 m, *Fagus orientalis-Carpinus caucasica-C. orientalis* forest.

22: RUSSIA. KARACHAVEVO-CIRCASSIAN REPUBLIC: Teberda town, left bank of Teberda River at 1 km upstream of Teberda Biosphere Reserve office, 43°26'41"N, 41°44'06"E, elev. 1350 m, freestanding deciduous trees in a pasture.

Results and discussion

To date, 248 species of lichenicolous fungi from 98 genera, 44 families, 25 orders and 8 classes of ascomycetes (97% of all species) and basidiomyetes (3%) are known at the Caucasus (see the checklist section below). The most species-rich classes of fungi were the Dothideomycetes (61 species), Eurotiomycetes (50) and Arthoniomycetes (34); the leading orders are Verrucariales (32), Arthoniales (25) and Abrothallales (16); while the most species-rich genera were *Stigmidium* (20), *Arthonia* (16) and *Abrothallus* (10).

Most species (81%) of the listed lichenicolous fungi were found in the Caucasus on only one host genus, and some, such as *Perigrapha superveniens* on *Parmelia sulcata*, even on just one host species. However, some species were found on a wide range of hosts, such as *Marchandiomyces corallinus* found on 15 lichen genera, *Lichenoconium erodens* found on 13 lichen genera, *Muellerella erratica* found on 12 lichen genera, *Lichenoconium usneae* found on eight lichen genera, *Lichenostigma maureri* found on seven lichen genera, and *Lichenoconium lecanorae* found on six lichen genera.

Ninety-eight genera of lichenicolous fungi were found in the Caucasus on 96 genera of host lichens. It is noteworthy that similar a nearly 1:1 ratio of parasite genera to host genera has previously been reported for the arctic lichenicolous mycobiota (Zhurbenko 2013c). The ten most frequently parasitized lichen genera were *Lecanora* s. l. (supporting 25 species of lichenicolous fungi), *Parmelia* (23), *Peltigera* (21), *Cladonia* (20), *Physcia* (19), *Pertusaria* (13), *Hypogymnia* (11), *Caloplaca* (10), *Physconia* (10) and *Usnea* (10). In comparison, the most frequently parasitized genera in the Arctic were: *Peltigera* (supporting 36 species of lichenicolous fungi), *Lecanora* s. l. (22), *Cladonia* (21), *Stereocaulon* (21), *Pertusaria* (18), *Solorina* (16), *Caloplaca* (15), *Ochrolechia* (13), *Lecidea* (10), *Parmelia* (10) and *Xanthoria* (10). In both regions the most parasitized genera included *Lecanora* s. l., *Cladonia* and *Peltigera*, which are generally considered to be frequently parasitized by a wide diversity of lichenicolous fungi (Lawrey & Diederich 2017). Nonetheless, the mycobiota of the Caucasus is unusual in that certain genera were more frequently parasitized, such as *Parmelia*, *Physcia*, *Physconia* and *Usnea*, in comparison to the Arctic where more frequent hosts were such genera as *Stereocaulon* and *Solorina* (Zhurbenko 2013c).

Approximately half of the species found in the Caucasus have been reported from outside the Holarctic (Brackel 2014), these include (sub)cosmopolitan species such as *Corticifraga fuckelii*, *Dactylospora lobariella*, *Lichenoconium lecanorae*, *Lichenostigma cosmopolites*, *Muellerella erratica*, *Nesolechia oxyspora*, *Phaeopyxis punctum*, *Pyrenidium actinellum* and *Roselliniella cladoniae*. Likewise approximately half of the species found in the Caucasus occur in the Arctic (Kristinsson et al. 2010). However, just a few of the species shared between the Caucusus and Arctic are characterized by arctic-

alpine distribution patterns (e.g., *Cercidospora verrucosaria*, *Endococcus sendtneri*, *Lichenochora caloplacae*, *L. rinodinae*, *Odontotrema thamnoliae*, *Stigmidium frigidum* and *Thamnogalla crombiei*).

Assuming that currently about 1350 species of lichens and 243 species of lichenicolous fungi are known from the Russian Caucasus (Urbanavichus & Urbanavichene 2014, present paper), the value of the lichenicolous index (the ratio of the number of lichenicolous fungi species to the number of lichen species; Zhurbenko 2011) for this territory is approximately 0.2, which is comparable to the values for such well-studied areas as Fennoscandia and the British Isles (Zhurbenko 2011).

Hitherto the only focused studies of lichenicolous fungi in the Caucasus were conducted in the northwestern part of the region, mainly in the Teberda and Caucasian Biosphere Reserves in the summers of 2012 and 2014 (Zhurbenko & Kobzeva 2014, 2016; Zhurbenko & Pino-Bodas 2017; Zhurbenko et al. 2015b, c; present paper). During these studies 41 habitats were inventoried and these efforts revealed 181 species of lichenicolous and allied fungi, 144 (80%) of which were found to be new to the Caucasus and four of which (2%) were described as new to science. Despite this intensive search just 12 of these 181 species were found more than ten times: *Lichenostigma maureri* (22 finds), *Marchandiomyces corallinus* (19), *Lichenoconium erodens* (18), *L. lecanorae* (18), *Nesolechia oxyspora* (15), *Arthophacopsis parmeliarum* (14), *Lichenoconium usneae* (14), *Nectriopsis lecanodes* (13), *Muellerella erratica* (12), *Abrothallus parmeliarum* (11), *Dactylospora lobariella* (11) and *Plectocarpon lichenum* (10). In this regard, it is worthwhile to note that only about 25% of the detected species were visible to the naked eye, 60% were clearly visible only at 10× magnification, and 15% only at 20–40× magnification. Visual analysis of the interactions between the lichenicolous fungi and lichens (*sensu* Lawrey & Diederich 2003) revealed that about 3% of them were saprotrophs, 15% were pathogens, 11% induced galls, 36% induced restricted discolorations, and 35% were commensals.

THE CHECKLIST

The checklist presented below is intended to be a comprehensive synopsis of the lichenicolous fungi known from the study area. The list is arranged alphabetically by genus and species, and the supporting voucher specimens or published literature citations are provided in each entry. Species that are newly reported for the Caucasus are given in bold; lichenicolous lichens are designated by '[L]'.

Abrothallus acetabuli Diederich

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Pleurosticta acetabulum* (Urbanavichus & Urbanavichene 2015b).

Abrothallus bertianus De Not.

Specimens examined (both on apothecia and thalli of *Melanohalea olivacea*). – **9:** 16.viii.2014, *M.P. Zhurbenko 14206b* (LE 309422b); **18:** 29.viii.2014, *M.P. Zhurbenko 14334a* (LE 309424a).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Melanelixia fuliginosa*, *M. glabra*, *M. glabratula*, *M. subaurifera*, *Melanohalea exasperata* and *Tuckermannopsis sepincola* (Blinkova & Urbanavichus 2005; Otte 2005, 2007; Urbanavichus & Urbanavichene 2014, 2015a; Zhurbenko & Kobzeva 2014, 2016; Zhurbenko & Otte 2012).

Abrothallus caerulescens I. Kotte

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory; on *Xanthoparmelia stenophylla* (Urbanavichus & Urbanavichene 2015a, Zhurbenko & Kobzeva 2014).

Abrothallus cetrariae I. Kotte

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Platismatia glauca* (Zhurbenko & Kobzeva 2014).

Abrothallus chrysanthus Stein

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Usnea* sp. (Urbanavichus & Ismailov 2013).

Abrothallus cf. *chrysanthus* Stein

NOTES. – The examined material is conspecific with that reported from the Caucasus by Zhurbenko and Kobzeva (2014). It differs from the description published by Etayo and van den Boom (2006) in having a hymenium that is partly purplish (vs. yellowish). The range of the ascospore size is also slightly larger ((6.5–)7.6–9.6(–11.5) × (3.0–)3.5–4.3(–5.0) µm, l/b = (1.8–)2.0–2.4(–2.9) (n=65) in our material vs. 8–10 × 3–4.5 µm *fide* Etayo & van den Boom 2006).

Specimens examined. – **17:** on *Usnea subfloridana* (darkened branch bases), 31.viii.2014, *P.M. Zhurbenko s.n.* (LE 309613); **18:** on *U. florida* (apothecia), 29.viii.2014, *M.P. Zhurbenko 14378* (LE 309565).

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Usnea dasypoga* (Zhurbenko & Kobzeva 2014).

Abrothallus microspermus Tul. (syn. *Vouauxiomyces truncatus* (B. de Lesd.) Dyko & D. Hawksw.)

Specimens examined (all on thalli of *Flavoparmelia caperata*). – **15:** 26.viii.2014, *M.P. Zhurbenko 14306* (LE 309382); 2.ix.2014, *M.P. Zhurbenko 14215* (LE 309430); **21:** 6.ix.2014, *M.P. Zhurbenko 14204* (LE 309429).

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Flavoparmelia caperata* and *Flavopunctelia soredica* (Otte 2004, Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2015b).

Abrothallus cf. *microspermus* Tul.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Flavopunctelia flaventior* (Zhurbenko & Kobzeva 2014).

Abrothallus parmeliarum (Sommerf.) Arnold

NOTES. – All specimens except LE 309404 are also infected by *Nesolechia oxyspora*. *Abrothallus parmeliarum* often grows on gall-like thallus modifications induced by the former species. This is a common parasite reported on members of the Parmeliaceae, mainly on *Parmelia*, with a subcosmopolitan distribution (Brackel 2014), which is here newly reported for the Krasnodar Territory of Russia.

Specimens examined. – **2:** on *Parmelia sulcata* (thallus), 8.viii.2014, *M.P. Zhurbenko 14311b* (LE 309377b); **4:** on *P. sulcata* (thallus), 10.viii.2014, *M.P. Zhurbenko 14269b* (LE 309405b); **18:** on *P. sulcata* (thallus), 27.viii.2014, *M.P. Zhurbenko 14305a* (LE 309383a); 28.viii.2014, *M.P. Zhurbenko 14325a* (LE 309409a); 29.viii.2014, *M.P. Zhurbenko 14267b* (LE 309407b); 29.viii.2014, *M.P. Zhurbenko 14336c* (LE 309426c); **19:** on *P. saxatilis* (thallus), 28.viii.2014, *P.M. Zhurbenko s.n.* (LE 309404).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Parmelia sulcata* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Abrothallus peyritschii (Stein) Kotte

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Republic of North Ossetia – Alania; on *Vulpicida pinastri* (Urbanavichus & Urbanavichene 2014, Vainio 1899, Zhurbenko & Kobzeva 2016).

Abrothallus prodiens (Harm.) Diederich & Hafellner

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, on *Hypogymnia physodes* (Blinkova et al. 2004, Zhurbenko & Kobzeva 2014).

Abrothallus cf. *prodiens* (Harm.) Diederich & Hafellner

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, on *Hypogymnia physodes* (Zhurbenko & Otte 2012).

Abrothallus stroblii Hafellner

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Menegazzia terebrata* (Zhurbenko & Kobzeva 2016).

Acremonium antarcticum (Speg.) D. Hawksw.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Rusavskia elegans* (Zhurbenko & Kobzeva 2016).

***Acremonium pertusariae* Brackel & Etayo**

NOTES. – The examined material fits the protologue (Brackel et al. 2012) in most respects except that the conidia are slightly wider ((4.7–)5.4–6.8(–8.5) × (2.8–)3.0–3.6(–4.1) µm, l/b = (1.3–)1.6–2.2(–3.0) (n=58) in our material vs. (4–)4.5–7.4(–9.5) × (2–)2.1–2.8(–3) µm). It is noteworthy that aggregations of released conidia on the host surface resemble translucent orange droplets, and the host tissues are bleached under heavy infections. The species was formerly known from the Canary Islands, mainland Spain, Italy and Germany (Brackel 2014, Brackel et al. 2012), and is here newly documented for Asia and Russia.

Specimens examined (all on thalli and soralia of *Lepra albescens*). – **4:** 10.viii.2014, *M.P. Zhurbenko 14395b* (LE 309591b); **17:** 31.viii.2014, *P.M. Zhurbenko s.n.* (LE 309593a); **21:** 6.ix.2014, *M.P. Zhurbenko 14496b* (LE 309594b).

Adelococcus alpestris (Zopf) Theiss. & Syd.

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Acarospora glaucocarpa*, *A. macrospora* and *Acarospora* sp. (Urbanavichus & Urbanavichene 2014, Zhurbenko & Otte 2012).

Anthostomella apogyra (Nyl.) Sacc. & D. Sacc.

LITERATURE REPORT. – **GEORGIA:** on *Umbilicaria polyphylla* (Matzer & Hafellner 1990).

Arthonia apotheciorum (A. Massal.) Almq.

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Lecanora agardhiana*, *L. crenulata* (Urbanavichus & Ismailov 2013).

Arthonia clemens (Tul.) Th. Fr.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Rhizoplaca chrysoleuca* (Zhurbenko & Kobzeva 2016).

Arthonia coronata Etayo

NOTE. – This species was formerly known in Russia only from the Caucasus (see literature report below), and is here newly reported from the Karachayevo-Circassian Republic of Russia.

Specimen examined. – **22:** on *Flavoparmelia caperata* (thallus), 29.viii.2012, *M.P. Zhurbenko 1226a* (LE 309621).

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Flavoparmelia caperata* (Zhurbenko & Kobzeva 2016).

***Arthonia destruens* Rehm in Rabenh.**

NOTE. – The species is known from scattered reports in both hemispheres (Brackel 2014), and is here newly documented for Asia and Russia.

Specimen examined. – **10:** on *Physcia stellaris* (thallus), 23.viii.2014, *P.M. Zhurbenko s.n.* (LE 308475).

Arthonia digitatae Hafellner s. l.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Cladonia* cf. *pyxidata* (Zhurbenko & Pino-Bodas 2017).

Arthonia diploiciae Calat. & Diederich

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Diploicia canescens* (Urbanavichus & Urbanavichene 2015b).

Arthonia epiphyscia Nyl.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya, Republic of Daghestan; on *Physcia aipolia* and *P. stellaris* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014).

Arthonia excentrica Th. Fr.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Lepraria* sp. (Zhurbenko & Kobzeva 2014).

Arthonia hertelii (Calat., Barreno & V.J. Rico) Hafellner & V. John

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Aspicilia desertorum* (Urbanavichus & Ismailov 2013).

Arthonia microsticta Vain.

NOTES. – *Arthonia microsticta* is "a species of doubtful application" (Lawrey & Diederich 2017). It was described as a lichenized ascomycete growing on tree leaves (Vainio 1896), but later also reported as a lichenicolous fungus growing on foliicolous lichens, probably on *Fellhanera bouteillei* (Santesson 1952). According to Matzer (1996) its life strategy and taxonomic status is unclear because 1) its holotype is in poor condition; 2) specimens of *Arthonia* clearly growing on *Fellhanera bouteillei* more closely resemble *A. subvelutinae* (Vain.) R. Sant. than the closely related *A. microsticta*. Sérusiaux (1996) suggested that *A. microsticta* might represent foliicolous morphs of the widesperead ubiquitous lichen *A. muscigena* Th. Fr. On the other hand, Roux et al. (2003) accepted *A. microsticta* and characterized it as a lichen, starting its life cycle as a parasite on foliicolous lichens, later becoming independent.

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, on unspecified host lichen on leaves (Vězda 1980), which is probably *Fellhanera bouteillei* (Santesson 1952); on leaves of *Buxus colchica* and *Hedera* sp. (Urbanavichene & Urbanavichus 2016).

Arthonia molendoi (Frauenf.) R. Sant.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Calogaya lobulata*, *Parvoplaca tiroliensis* and *Rusavskia elegans* (Urbanavichus & Urbanavichene 2014, 2015a; Zhurbenko & Kobzeva 2014, 2016).

Arthonia peltigerina (Almq.) H. Olivier

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Solorina saccata* (Urbanavichus & Ismailov 2013).

Arthonia phaeophysciae Grube & Matzer

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Phaeophyscia hirsuta* (Urbanavichus & Ismailov 2013).

Arthonia stereocaulina (Ohlert) R. Sant.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Stereocaulon alpinum* (Zhurbenko & Kobzeva 2014).

Arthonia subfuscicola (Linds.) Triebel

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Lecanora carpinea* and *L. leptyrodes* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014, 2015a).

Arthonia varians (Davies) Nyl.

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of North Ossetia – Alania, Republic of Daghestan; on *Lecanora rupicola* s. l., *L. rupicola* ssp. *subplanata* (Urbanavichus & Ismailov 2016, Urbanavichus & Urbanavichene 2015a, Vainio 1899).

Arthophacopsis parmeliarum Hafellner

NOTE. – This species is confined to members of the genus *Parmelia* s. str. (Lawrey & Diederich 2017) and is quite common in the Caucasus. Nonetheless it is here newly reported for the Krasnodar Territory of Russia.

Specimens examined. – **2:** on *Parmelia sulcata* (thallus), 8.viii.2014, *M.P. Zhurbenko 14312* (LE 309376); **4:** on *P. sulcata* (thallus), 10.viii.2014, *M.P. Zhurbenko 14315* (LE 309373); **9:** on *P. saxatilis* (thallus), 16.viii.2014, *M.P. Zhurbenko 14335* (LE 309425); **18:** on *P. sulcata* (thallus), 27.viii.2014, *M.P. Zhurbenko 14491* (LE 309574); 28.viii.2014, *M.P. Zhurbenko 14490* (LE 309575); 28.viii.2014, *M.P. Zhurbenko 14492* (LE 309573); 29.viii.2014, *M.P. Zhurbenko 14267a* (LE 309407a); 29.viii.2014, *M.P. Zhurbenko 14336a* (LE 309426a).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Parmelia omphalodes*, *P. saxatilis*, *P. serrana* and *P. sulcata* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Athelia arachnoidea (Berk.) Jülich

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Physconia distorta* (Zhurbenko & Kobzeva 2014, 2016).

Bachmanniomyces uncialicola (Zopf) D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Cladonia arbuscula* (Zhurbenko & Kobzeva 2014, Zhurbenko & Pino-Bodas 2017).

Bellemerella polysporinae Calat. & Nav.-Ros.

LITERATURE REPORT – **RUSSIA:** Republic of Daghestan; on *Polysporina subfuscescens* (Urbanavichus & Ismailov 2016).

Biatoropsis usnearum Räsänen agg.

LITERATURE REPORTS. – **RUSSIA**: Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Usnea dasypoga*, *U. florida*, *U. glabrata*, *U. intermedia* and *Usnea* spp. (Urbanavichene & Urbanavichus 2014, 2016; Urbanavichus & Urbanavichene 2014; Zhurbenko & Kobzeva 2014).

Briancoppinsia cytospora (Vouaux) Diederich, Ertz, Lawrey & van den Boom

NOTES. – This widely distributed species is known from a wide range of host genera, mainly members of the Parmeliaceae (Brackel 2014). However, it is here newly reported from the host genus *Usnea*, as well as from the Krasnodar Territory of Russia.

Specimens examined. – **9:** on adjacent thalli of *Hypogymnia physodes* and *H. tubulosa*, 16.viii.2014, *M.P. Zhurbenko 14222* (LE 309399); on *Parmelia sulcata* (thallus), 16.viii.2014, *M.P. Zhurbenko 14321* (LE 309398); **18:** on *Usnea florida* (apothecia), 28.viii.2014, *P.M. Zhurbenko s.n.* (LE 309557b).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Hypogymnia physodes* (Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Carbonea vitellinaria (Nyl.) Hertel

NOTE. – In the examined material the ascomata were associated with conidiomata containing hyaline, narrowly oblong, aseptate conidia that measure 3.8–4.5 × 1.2–1.4 µm. These differ from the prior reports of conidia in *Carbonea* species which are characterized as thread-like and curved (Chambers et al. 2009). The author is unaware of other descriptions of conidia in this species.

Specimen examined. – **1:** on *Candelariella vitellina* (thallus), 6.viii.2014, *M.P. Zhurbenko 14427* (LE 309498).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Candelariella vitellina* and a non-specified host lichen (Blinkova & Urbanavichus 2005; Zhurbenko & Kobzeva 2014, 2016).

Cecidonia umbonella (Nyl.) Triebel & Rambold

LITERATURE REPORTS. – **RUSSIA:** Kabardino-Balkarian Republic, Republic of North Ossetia - Alania; on *Lecidea lapicida* including *L. lapicida* var. *pantherina* (Hertel 2001, Triebel & Rambold 1988).

Cercidospora melanophthalmae Nav.-Ros., Calat. & Hafellner

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Rhizoplaca melanophthalma* (Zhurbenko & Kobzeva 2014).

***Cercidospora* cf. *rinodinae* Etayo & van den Boom**

NOTES. – The examined material differs from the protologue (Etayo & van den Boom 2005) in the following features: 1) pigmented upper part of the exciple brown to olive gray, often green or bluish green around the ostiole, K–, N+ moderate red (vs. black with a violaceous hue, K+ blue-black, N+ purple-violet); 2) interascal filaments 1.5(–2) µm in diameter (vs. ca. 1 µm in diameter); 3) ascospores slightly wider, (13.5–)14.2–17.0(–18.7) × (4.5–)4.9–5.5(–5.8) µm, l/b = (2.4–)2.7–3.3(–3.8) (n=35) (vs. (12.5–)14–17(–20) × 3.5–4.5 µm), occasionally with a halo up to 1.5 µm thick (vs. no halo mentioned in the protologue). The other species of *Cercidospora* reported on *Rinodina*, *C. exiguella* (Nyl.) Arnold, differs from the examined material in having a blue exciple and much longer ascospores (21–27 × 6–8 µm; Etayo & van den Boom 2005). It is noteworthy that the infected humicolous *Rinodina roscida* that was examined for this study was intermixed with *Megaspora verrucosa*, which is the host species for *Cercidospora verrucosaria*. However, the latter is distinguished by its bluish green or grayish green exciple, almost consistently 8-spored asci and somewhat longer ascospores that are mainly longer than 18 µm (Navarro-Rosinés et al. 2004, Zhurbenko 2008, material of *C. verrucosaria* examined in this study). To date, *C. rinodinae* is known with certainty only from the type collection made in the Canary Islands where it was found on the thallus and thalline margin of humicolous *Rinodina conradii* (Etayo & van den Boom 2005).

Specimen examined. – **14:** on *Rinodina roscida* (apothecial discs, occasionally thallus), 21.viii.2014, *P.M. Zhurbenko s.n.* (LE 309611).

Cercidospora stenotropae Nav.-Ros. & Hafellner ad int.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Lecanora polytropa* agg. (Zhurbenko & Kobzeva 2016).

***Cercidospora verrucosaria* (Linds.) Arnold**

NOTES. – This species is widely distributed in the northern hemisphere (Brackel 2014) and has also been found in the southern hemisphere (New Zealand; Hafellner & Mayrhofer 2007), always growing on *Megaspora verrucosa*. It was previously found in Russia in the Ural Mountains and Siberia (Zhurbenko 2009a, b), and is here newly documented for the Caucasus.

Specimen examined. – **14:** on *Megaspora verrucosa* (apothecial discs, thallus), 21.viii.2014, *M.P. Zhurbenko 14409* (LE 309541).

Chaenothecopsis brevipes Tibell

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Arthonia* sp. and unspecified host lichens (Titov 1998, 2006).

Chaenothecopsis consociata (Nádv.) A.F.W. Schmidt

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Chaenotheca chrysocephala* and unspecified host lichens (Titov 2006, Urbanavichus & Urbanavichene 2014).

Chaenothecopsis hospitans (Th. Fr.) Tibell

LITERATURE REPORT. – **GEORGIA:** Borzhomi Region, on *Lecanora carpinea* (Titov 1998).

Chaenothecopsis ochroleuca (Körb.) Tibell & K. Ryman

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Lecanora thysanophora* (Otte 2004).

Cladophialophora parmeliae (Etayo & Diederich) Diederich & Unter.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on parmelioid lichen (Zhurbenko & Kobzeva 2016).

Clypeococcum cetrariae Hafellner

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory; on *Cetraria islandica* and *Flavocetraria cucullata* (Zhurbenko & Kobzeva 2014, 2016).

Clypeococcum cladonema (Wedd.) D. Hawksw.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Flavoparmelia caperata* (Zhurbenko & Kobzeva 2016).

Clypeococcum hypocenomycis D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Hypocenomyce scalaris* (Otte 2007; Urbanavichus & Urbanavichene 2014, 2015a).

***Cornutispora ciliata* Kalb**

NOTES. – This subcosmopolitan species has been reported from a wide range of host genera, but not yet from *Flavoparmelia* (Brackel 2014). It was formerly known in Russia only from the Sayan Mountains in Siberia (Zhurbenko 2012b), and is here newly documented for the Caucasus.

Specimens examined. – **18:** on *Ochrolechia pallescens* (apothecia, occasionally thallus), 28.viii.2014, *M.P. Zhurbenko 14494a* (LE 309580a); **20:** on *Flavoparmelia caperata* (thallus), 10.ix.2014, *M.P. Zhurbenko 14327* (LE 309412).

Cornutispora lichenicola D. Hawksw. & B. Sutton

NOTES. – This is a common cosmopolitan species reported from a wide range of distantly related host genera, but not yet from *Cetrelia* (Brackel 2014). It was formerly known in Asian Russia only from the Irkutsk Region (Zhurbenko & Vershinina 2014), and is here newly documented for the Caucasus.

Specimens examined. – **5:** on *Cetrelia olivetorum* (thallus), 10.viii.2014, *M.P. Zhurbenko 14211b* (LE 309411b); **6:** on *Lecanora pulicaris* (apothecial discs and margins), 15.viii.2014, *M.P. Zhurbenko 14462* (LE 309514).

Corticifraga fuckelii (Rehm) D. Hawksw. & R. Sant.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Peltigera praetextata* and *Peltigera* sp. (Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Corticifraga peltigerae (Fuckel) D. Hawksw. & R. Sant.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Peltigera polydactylon* agg. (Zhurbenko & Kobzeva 2014).

Dacampia engeliana (Saut.) A. Massal.

LITERATURE REPORTS. – **RUSSIA:** Republic of Daghestan, Republic of Adygeya; on *Solorina saccata* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014).

[L]*Dacampia hookeri* (Borrer) A. Massal.

NOTES. – This is a facultatively lichenicolous lichen, sometimes beginning its life as a juvenile parasite on *Solorina* species (Henssen 1995). It occurs in both hemispheres and is quite common in arctic and alpine environments (Brackel 2014). In Russia it has formerly been reported only from the Arctic (Zhurbenko 2009a, Zhurbenko & Santesson 1996), and is here newly documented for the Caucasus where it was found in alpine habitats.

Specimens examined. – **14:** on organic soil, 21.viii.2014, *M.P. Zhurbenko 14408* (LE 309501); on *Solorina* sp. (thallus), 21.viii.2014, *M.P. Zhurbenko 14405* (LE 309551).

***Dacampia rufescentis* (Vouaux) D. Hawksw.**

NOTE. – This species was formerly known in Russia from the Republic of Karelia, Komi Republic, Krasnoyarsk Territory and Chukotka Autonomous Area (Alstrup 2004; Zhurbenko 2004, 2009b). It is here newly documented for the Caucasus.

Specimen examined. – **12:** on *Peltigera horizontalis* (bleached parts of lobes), 23.viii.2014, *M.P. Zhurbenko 14350* (LE 309461).

***Dactylospora athallina* (Müll. Arg.) Hafellner**

NOTE. – This species was formerly known in Russia only from the Murmansk Region (Zhurbenko 2001), and is here newly documented for Asian Russia.

Specimen examined. – **14:** on *Baeomyces rufus* (thallus), 21.viii.2014, *M.P. Zhurbenko 14406* (LE 3094885).

Dactylospora deminuta (Th. Fr.) Triebel

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Biatora subduplex*, *Fuscopannaria praetermissa*, *Gyalecta foveolaris* and *Protopannaria pezizoides* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014).

Dactylospora homoclinella (Nyl.) Hafellner

LITERATURE REPORT. – **REPUBLIC OF ABKHAZIA:** on *Buellia griseovirens* and *Lepra albescens* (Urbanavichus & Urbanavichene 2012).

Dactylospora lobariella (Nyl.) Hafellner

NOTES. – This is a subcosmopolitan species reported on many species of *Lobaria* and *Ricasolia* (Brackel 2014), that also occurs on species of *Pseudocyphellaria* (Hafellner & Mayrhofer 2007) and *Sticta* (Flakus & Kukwa 2012). In addition to the Caucasus, it was formerly known in Russia from the Komi Republic, Krasnoyarsk Territory, Republic of Altai and Primorye Territory (Kondratyuk et al. 2015; Zhurbenko 2004, 2012b; Zhurbenko & Davydov 2000).

Specimens examined. – **4:** on *Lobaria pulmonaria* (thallus), 10.viii.2014, *M.P. Zhurbenko 14366b* (LE 309539b); **5:** on *L. pulmonaria* (thallus), 10.viii.2014, *M.P. Zhurbenko 14365b* (LE 309529b); on *Ricasolia amplissima* (thallus), 10.viii.2014, *M.P. Zhurbenko 14367b* (LE 309538b); **7:** on *L. pulmonaria* (thallus), 13.viii.2014, *M.P. Zhurbenko 14373b* (LE 309532b); **17:** on *L. pulmonaria* (thallus), 1.ix.2014, *M.P. Zhurbenko 14361a* (LE 309536a).

LITERATURE REPORTS. – **REPUBLIC OF ABKHAZIA:** on *Lobaria pulmonaria* and *Ricasolia amplissima* (Urbanavichus & Urbanavichene 2012). **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Lobaria pulmonaria* and *Ricasolia amplissima* (Otte 2007; Urbanavichene & Urbanavichus 2014, 2016; Urbanavichus & Urbanavichene 2014; Zhurbenko & Kobzeva 2014; Zhurbenko & Otte 2012).

Dactylospora parasitica (Flörke) Zopf

NOTES. – Hafellner (2004) reported the ascospore size range of this species to be 9–15 × 3.5–5 µm, which differs slightly from that of material cited here: (7.8–)9.7–12.7(–15.6) × (3.0–)3.6–4.4(–5.0) µm, l/b = (2.1–)2.4–3.2(–3.8) (n=99).

Specimens examined. – **1:** on sterile white crustose lichen with soralia growing on plant remnants over ground, 5.viii.2014, *M.P. Zhurbenko 14436* (LE 309543); **4:** on *Lepra albescens* (thallus), 10.viii.2014, *M.P. Zhurbenko 14395a* (LE 309591a); **21:** on *L. albescens* (thallus), 6.ix.2014, *M.P. Zhurbenko 14495* (LE 309590); **20:** on *Pertusaria hymenea* (fruiting warts, thallus), 10.ix.2014, *M.P. Zhurbenko 14471* (LE 309592).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Lepra albescens* and *Ochrolechia* sp. (Otte 2004, Urbanavichus & Urbanavichene 2015a, Zhurbenko & Kobzeva 2014).

Dactylospora saxatilis (Schaer.) Hafellner var. *saxatilis*

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on saxicolous *Pertusaria* sp. (Zhurbenko & Otte 2012).

Dactylospora tegularum (Arnold) Hafellner

NOTES. – With the exception of occurring on somewhat unusual host, the examined material fits well the species description published by Hafellner (1979), including the size of the ascospores ((9.6–)10.2–12.6(–13.6) × (4.7–)4.9–6.4(–7.7) µm, l/b = (1.6–)1.7–2.3(–2.6) (n=31) in the specimens examined). The species was formerly known with certainty only from Great Britain, Germany and Bolivia where it was fround on saxicolous species of *Caloplaca* s. l. (*C. teicholyta*, *C.* sp. and *Rufoplaca arenaria*; Brackel 2014, Flakus & Kukwa 2012). It was also reported by Vainio (1899: 305) from an unidentified

location in the Caucasus or Crimea without an indication of the host. The species is here newly reported from *Bryoplaca sinapisperma* and its presence in Russia and Asia is verified.

Specimen examined. – **14:** on *Bryoplaca sinapisperma* (thallus) growing on bryophytes, 21.viii.2014, *M. P. Zhurbenko 14454* (LE 309488).

LITERATURE REPORT. – Caucasus or Crimea, locality and host lichen not specified (Vainio 1899).

Didymellopsis pulposi (Zopf) Grube & Hafellner

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Lathagrium auriforme* (Urbanavichus & Urbanavichene 2014).

Didymocyrtis bryonthae (Arnold) Hafellner (syn. *Polycoccum bryonthae* (Arnold) Vězda)

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Lecanora saligna* (Urbanavichus & Ismailov 2013).

***Didymocyrtis consimilis* Vain.** (syn. *Phoma caloplacae* D. Hawksw.)

NOTES. – The species seems to be highly variable morphologically. Ertz et al. (2015) characterized its asci as being 50–70 × 7–10 µm; ascospores as being pale brown, 12–15 × (4.5–)5–6(–6.5) µm, 1(–2)-septate, hardly constricted at the septum, indistinctly verruculose in light microscopy, and conidia as measuring 4.5–6.5 × 2.5–4.5 µm or (4–)5–6(–7) µm in diameter. In the specimens examined for this study the asci were 67–93 × 6.5–8 µm (n=9) in size, the ascospores were vivid yellow, (9.7–)10.6–12.6(–14.5) × (3.7–)4.4–5.4(–5.9) µm, l/b = (1.9–)2.1–2.7(–3.4) (n=41), (0–)1(–3)-septate, sometimes markedly constricted at the septum, distinctly verruculose at 1000× magnification in DIC, and the conidia were (4.4–)5.8–8.4(–10.0) × (3.9–)4.2–5.0(–5.4) µm, l/b = (1.0–)1.2–1.8(–2.5) (n=30). The species was formerly known in Russia from the Republic of Karelia, Republic of Bashkortostan, Krasnoyarsk Territory and Chukotka Autonomous Area (Hawksworth 1981, Räsänen 1939, Urbanavichus & Urbanavichene 2011, Zhurbenko 2009a), and is here newly documented for the Caucasus.

Specimens examined (all on hymenium of apothecia of *Parvoplaca tiroliensis*). – **1:** 5.viii.2014, *M.P. Zhurbenko 14440* (LE 309490); 6.viii.2014, *M.P. Zhurbenko 14431* (LE 309489); **14:** 21.viii.2014, *P.M. Zhurbenko s.n.* (LE 309491).

Didymocyrtis epiphyscia Ertz & Diederich (syn. *Phoma physciicola* Keissl.)

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Anaptychia ciliaris* and *Physcia caesia* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2016).

Didymocyrtis foliaceiphila (Diederich, Kocourk. & Etayo) Ertz & Diederich

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Cladonia uncialis* (Zhurbenko & Pino-Bodas 2017).

Didymocyrtis kaernefeltii (S.Y. Kondr.) Hafellner (syn. *Polycoccum kaernefeltii* S.Y. Kondr.)

LITERATURE REPORT. – **RUSSIA:** Stavropol Territory, on *Caloplaca cerina* (Zhurbenko & Kobzeva 2014).

Didymocyrtis ramalinae (Desm.) Ertz, Diederich & Hafellner (syn. *Leptosphaeria ramalinae* (Desm.) Sacc.)

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Daghestan; on *Ramalina capitata*, *R. fastigiata* (Urbanavichus & Ismailov 2016, Urbanavichus & Urbanavichene 2015b).

Echinothecium reticulatum Zopf

NOTES. – According to Brackel (2014), *Cetrelia* is a new host genus and *Parmelia ernstiae* is a new host species for *Echinothecium reticulatum*. The species is widely distributed in Russia (Zhurbenko 2009a), but still newly reported here for the Krasnodar Territory.

Specimens examined. – **2:** on *Parmelia sulcata* (thallus), 8.viii.2014, *M.P. Zhurbenko 14217* (LE 309397); **18:** on *P. sulcata* (thallus), 28.viii.2014, *M.P. Zhurbenko 14268* (LE 309408); 29.viii.2014, *M.P. Zhurbenko 14267d* (LE 309407d); **19:** on *Cetrelia olivetorum* (thallus), 30.viii.2014, *M.P. Zhurbenko 14324b* (LE 309403b); **19:** on *P. ernstiae* (thallus), 30.viii.2014, *M.P. Zhurbenko 14221* (LE 309396).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Parmelia saxatilis*, *P. sulcata* and *Pseudevernia furfuracea* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Endococcus incrassatus Etayo & Breuss

NOTES. – The examined material differs somewhat from the protologue (Etayo & Breuss 2001), where ascomata were reported as being up to 200 µm in diameter (vs. up to 375 µm in the specimens examined), and ascospores 10.5–14 × 6–8 µm, with cells unequal in size and shape (vs. broadly ellipsoid to ellipsoid, (10.4–)11.7–13.9(–16.8) × (6.1–)6.9–8.7(–9.7) µm, l/b = (1.3–)1.4–1.8(–2.2) (n=56), not constricted at the septum, usually with equal cells, verruculose, guttulate in the specimens examined). Nonetheless the material fits well the descriptions published by Zhurbenko and Kobzeva (2014) and Zhurbenko et al. (2012a).

Specimen examined. – **14:** on sterile squamulose lichen growing on organic soil, 21.viii.2014, *M.P. Zhurbenko 14411* (LE 309547).

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Stavropol Territory; on *Placidiopsis* cf. *cinerascens* and sterile squamulose lichen on soil (Zhurbenko & Kobzeva 2014, 2016).

Endococcus propinquus (Körb.) D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, Republic of Daghestan; on *Verrucaria endocarpoides* and *Verrucaria* sp. (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014).

Endococcus pseudocarpus Nyl.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Callome multipartita* (Urbanavichus & Urbanavichene 2014).

Endococcus ramalinarius (Linds.) D. Hawksw.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Ramalina farinacea* (Urbanavichene & Urbanavichus 2016).

Endococcus rugulosus Nyl.

LITERATURE REPORTS. – **RUSSIA:** Kabardino-Balkarian Republic, Republic of Adygeya; on *Verrucaria tristis* and an unspecified host lichen (Poelt 1968, Urbanavichus & Urbanavichene 2014).

***Endococcus sendtneri* (Arnold) Hafellner**

NOTES. – Ascospores pale to medium brown, ellipsoid to narrowly obovoid, (11.0–)11.9–15.3(–18.3) × (5.5–)6.4–7.6(–8.3) µm, l/b = (1.4–)1.6–2.4(–3.3) (n=54), (0–)1-septate, not or occasionally slightly constricted at the septum, smooth-walled or verruculose, non-halonate, 8 per ascus. The size of the ascospores evidently varies widely in this species, being 14–16.2–18 × 5–6.2–8 µm in the material examined by Hafellner et al. (2008) and (10.5–)13.1–17.7(–22) × (5–)6.4–9.2(–12.5) µm in the material examined by Zhurbenko and Brackel (2013). The species was formerly reported from Austria, Germany and Norway (Svalbard) (Brackel 2014, Hafellner et al. 2008, Zhurbenko & Brackel 2013), and is here newly documented for Asia and Russia.

Specimen examined. – **14:** on *Polyblastia sendtneri* (thallus), 21.viii.2014, *M.P. Zhurbenko 14410* (LE 309545).

Epibryon solorinae (Vain.) Nik. Hoffm. & Hafellner

LITERATURE REPORTS. – **GEORGIA:** on *Solorina bispora* (Hoffmann & Hafellner 2000, Vainio 1899).

Epicladonia sandstedei (Zopf) D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Cladonia ochrochlora* and *Cladonia* spp. (Zhurbenko & Kobzeva 2014, Zhurbenko & Pino-Bodas 2017).

Erythricium aurantiacum (Lasch) D. Hawksw. & A. Henrici (syn. *Marchandiobasidium aurantiacum* (Lasch) Diederich & Schultheis)

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Physcia stellaris* and *P. tenella* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014).

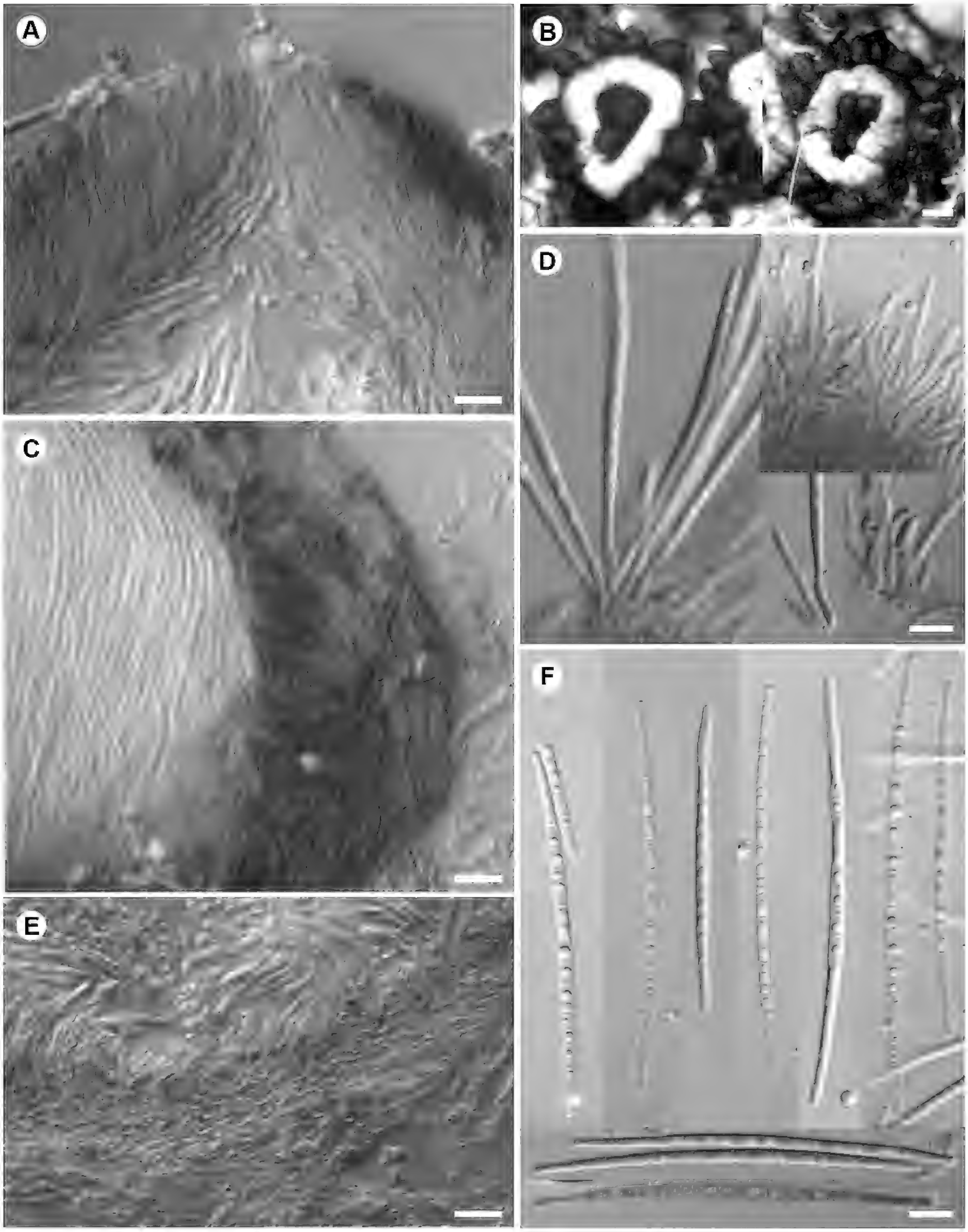

Figure 1, *Hainesia* cf. *xanthoriae* growing on *Ochrolechia parella* (all from LE 309609). A, upper part of conidioma in cross section in water. B, moist (left) and dry (right) ascomata. C, central part of conidioma in cross section in water. D, conidiophores and conidiogenous cells in phloxine and water (the top right). E, basal part of conidioma in cross section in water. F, conidia in water and phloxine (at the bottom). Scale bars: A, C–F = 10 μm, B = 200 μm.

Hainesia brevicladoniae Diederich & van den Boom

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Cladonia gracilis* and *C. pocillum* (Zhurbenko & Kobzeva 2014).

Hainesia xanthoriae Brackel

NOTE. – According to Suija et al. (in rev.) this name is a heterotypic synonym of *Hainesia aeruginascens* Brackel.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Hypogymnia physodes* (as *Hainesia aeruginascens*; Zhurbenko & Kobzeva 2014).

***Hainesia* cf. *xanthoriae* Brackel**

FIGURE 1

DESCRIPTION. – *Conidiomata* pycnidioid, glossy, in the moist state medium brown/olive brown, slightly translucent, ovoid to broadly ovoid in a side view, occasionally pyriform or subglobose, usually somewhat papillate, (140–)180–300(–430) µm in diameter, with a pore 10–30 µm in diameter, becoming irregularly gaping when overmature; in the dry state black, sometimes misshapen, occasionally bulged-in from above, with corrugate surface, (90–)140–260(–320) µm in diameter, immersed in the host tissues only at the base when mature, usually densely aggregated to concrescent. *Lateral exciple* composed of medium brown, K–, loosely interwoven branched, septate hyphae evidently connected with pale brown membrane. *Basal exciple* pale to medium brown, in cross section up to 25 µm thick, composed of 5–10 layers of tangentially elongated or more or less isodiametric cells; basal stroma not recognized. *Conidiophores* hyaline, lining the conidiomatal cavity, composed of 1–3 slightly clavate or oblong cells ca. 5–12 × 2–3 µm, mainly supporting two conidiogenous cells, occasionally branched. *Conidiogenous cells* hyaline, integrated, acropleurogenous, fusiform to oblong, (7.4–)8.4–10.8(–12.4) × (1.9–)2.2–2.6(–2.7) µm (n=35, in phloxine). *Conidia* hyaline, more or less filiform to vermiform, usually slightly gradually tapering towards the apices, occasionally with alternating cells of different diameter, with a broadly rounded apex and a truncate base, (62.0–)70.6–89.0(–116.0) × (2.3–)2.8–3.2(–3.6) µm, l/b = (21.4–)23.8–30.2(–37.4) (n=122, in water or phloxine), (0–)6–10(–11)-septate, not constricted at the septa, smooth-walled, usually with 1–3 conspicuous guttules in each cell. Heavy infections cause discoloration of the host tissues and disintegration of its hymenium.

NOTES. – Suija et al. (in rev.) showed that lichenicolous species of *Hainesia* are not host specific and more morphologically variable, especially concerning conidiomatal and conidial dimensions, than has previously been believed (Brackel 2009, 2014; Diederich & van den Boom 2013; Etayo & Diederich 1996; Zhurbenko 2013b; Zhurbenko & Brackel 2013). Given these results, the examined material is close to the broad concept of *H. xanthoriae* of Suija et al. (in rev.). However, a detailed description of the fungus on *Ochrolechia parella* is provided, as it differs from this concept of *H. xanthoriae* by its unusual host genus, as well as by having larger conidiomata (140–430 µm in diameter vs. 100–250 µm in diameter) and longer conidia with more septa (mainly 71–89 µm long with 6–10 septa vs. mainly 40–84 µm long with 0–5 septa). It is noteworthy that the only other *Hainesia* species previously reported from members of Pertusariales sensu Lücking et al. (2016) is *H. pertusariae* Etayo & Diederich, which differs from the present material by having 0–1(–3)-septate conidia that are much shorter, 10–24.5 × 1–1.5 µm (Etayo & Diederich 1996, Suija et al. in rev.).

Specimens examined (on apothecial discs and particularly thalline margins, occasionally on thalli of *Ochrolechia parella*). – **18:** 28.viii.2014, *M.P. Zhurbenko 14389* (LE 309609); 29.viii.2014, *M.P. Zhurbenko 14498* (LE 309608).

Halospora deminuta (Arnold) Tomas. & Cif.

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on undetermined endolithic lichen on limestone (Urbanavichus & Ismailov 2013).

Halospora discrepans (Arnold) Hafellner

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Protoblastenia rupestris* (Urbanavichus & Ismailov 2013).

Hawksworthiana peltigericola (D. Hawksw.) U. Braun

NOTES. – Conidiogenous cells monoblastic, elongate, subcylindrical or gradually expanding downward. Conidia narrowly ellipsoid, narrowly ovoid, occasionally narrowly obovoid, narrowly obpyriform, broadly ellipsoid or broadly lunate, with truncate and often attenuated base, (12.2–)15.0–19.8(–21.9) × (5.8–)6.3–7.9(–9.2) µm, l/b = (1.4–)2.1–2.9(–3.4) (n=32), aseptate or very rare with 1 septum. The material examined slightly differs from the description published by Braun (1995), wherein the conidiogenous cells were reported to be mono- to polyblastic, subcylindrical to usually ampulliform, and the conidia to be oblong-clavate to subcylindrical, 15–25 × 5–7 µm, 0–1-septate. The examined specimens are conspecific with those from the Karachayevo-Circassian Republic of Russia previously erroneously identified and reported as *Refractohilum peltigerae* (Keissl.) D. Hawksw. (Zhurbenko & Kobzeva 2014). The latter is similar in many respects to *Hawksworthiana peltigericola*, but can be distinguished by its conidiogenous cells with distinct annellations and constantly aseptate conidia (Hawksworth 1977a). In addition to the Caucasus, *H. peltigericola* was previously known in Russia from the Leningrad Region and Krasnoyarsk Territory (Kuznetsova et al. 2012, Zhurbenko 2012b), and is here newly reported for the Krasnodar Territory.

Specimens examined (all on thalli of *Peltigera praetextata*). – **12:** 23.viii.2014, *M.P. Zhurbenko 14354* (LE 309481); **16:** 1.ix.2014, *M.P. Zhurbenko 14355* (LE 309482); 1.ix.2014, *M.P. Zhurbenko 14343a* (LE 309480a); **18:** 29.viii.2014, *M.P. Zhurbenko 14351a* (LE 309478a).

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Peltigera* cf. *praetextata* [originally misidentified and published as *Refractohilum peltigerae* (Keissl.) D. Hawksw. in Zhurbenko & Kobzeva (2014)].

Heterocephalacria bachmannii (Diederich & M.S. Christ.) Millanes & Wedin

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Cladonia coniocraea* and *C. pyxidata* (Zhurbenko & Kobzeva 2014, Zhurbenko & Pino-Bodas 2017).

Heterocephalacria physciacearum (Diederich) Millanes & Wedin

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Physcia stellaris*, *P. tenella* and *P. vitii* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2016).

Homostegia piggotii (Berk. & Broome) P. Karst.

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Parmelia saxatilis* and *P. sulcata* (Urbanavichus & Ismailov 2013, Urbanavichene & Urbanavichus 2016, Zhurbenko & Otte 2012).

Illosporiopsis christiansenii (B.L. Brady & D. Hawksw.) D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya, Republic of Daghestan, Stavropol Territory; on *Lecanora subcarpinea*, *Phaeophyscia orbicularis*, *Physcia aipolia*, *P. stellaris*, *Physcia* sp., *Physconia distorta* and unidentified epiphytic species of Physciaceae (Zhurbenko & Kobzeva 2014, 2016; Zhurbenko & Otte 2012).

Intralichen christiansenii (D. Hawksw.) D. Hawksw. & M.S. Cole

Specimen examined. – **14:** on *Candelariella commutata* (hymenium of apothecia), 21.viii.2014, *P.M. Zhurbenko s.n.* (LE 309496).

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Daghestan, Stavropol Territory; on *Candelariella vitellina*, *Lecanora subcarpinea* and *Rusavskia elegans* (Urbanavichus et al. 2010; Zhurbenko & Kobzeva 2014, 2016).

Intralichen lichenicola (M.S. Christ. & D. Hawksw.) D. Hawksw. & M.S. Cole

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Candelariella aurella*, *C. efflorescens* and *C. vitellina* (Urbanavichus & Ismailov 2016; Urbanavichus & Urbanavichene 2014, 2015a).

Intralichen lichenum (Diederich) D. Hawksw. & M.S. Cole

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Cladonia pyxidata* (Zhurbenko & Kobzeva 2016).

Laeviomyces pertusariicola (Nyl.) D. Hawksw.

NOTES. – Hawksworth (1977b) reported conidia of the species as being pale brown, 3.5–6 × 2.5–3.5 µm, and aseptate. In comparison, the specimen examined for this study had conidia that were pale to medium brown, slightly smaller ((3.1–)3.7–4.7(–5.3) × (2.3–)2.5–3.1(–3.4) µm, l/b = (1.1–)1.2–1.8(–2.2) (n=44)), and typically simple but occasionally also 1-septate.

Specimen examined. – **20:** on epiphytic *Pertusaria* sp. (fertile verrucae, thallus), 10.ix.2014, *M.P. Zhurbenko 14385* (LE 309602).

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, on *Pertusaria leioplaca*, *P. pertusa*, *Pertusaria* sp. (Urbanavichus & Urbanavichene 2015a, Zhurbenko & Otte 2012).

Lambinonia strigulae (Elenkin & Woron.) Sérus. & Diederich

LITERATURE REPORTS. – **REPUBLIC OF ABKHAZIA:** on *Strigula buxi*, *S. nitidula* (Sérusiaux & Diederich 2005, Urbanavichus & Urbanavichene 2012). **RUSSIA:** Krasnodar Territory, on *S. buxi*, *S. nemathora* and *S. nitidula* (Elenkin & Woronichin 1908, Sérusiaux & Diederich 2005, Urbanavichene & Urbanavichus 2016).

***Lichenochora caloplacae* Zhurb.**

NOTES. – The size of the ascospores in the specimens examined generally matches those given in the protologue ((14.5–)17.6–22.8(–27.4) × (3.8–)4.7–6.5(–7.2) µm, l/b = (2.4–)2.7–4.7(–6.5) (n=72, in water or K) vs. (14.0–)17.4–22.8(–27.0) × (3.5–)4.0–5.0(–6.0) µm, l/b = (3.0–)3.8–5.2(–6.3) *fide* Zhurbenko & Brackel 2013). However the sizes of the ascospores varied considerably between the specimens examined. The species was formerly known only from the tundra and polar desert biomes of Svalbard and Severnaya Zemlya archipelago (Siberia) where it was found on *Blastenia ammiospila*, *Bryoplaca tetraspora* and *Caloplaca cerina*. Here *Bryoplaca sinapisperma* and *Parvoplaca tiroliensis* are reported as new hosts, and the species is newly documented outside the Arctic and from the Caucasus.

Specimens examined. – **14:** on *Bryoplaca sinapisperma* (thallus), 21.viii.2014, *M.P. Zhurbenko 14455* (LE 309494); on *Parvoplaca tiroliensis* (thallus, occasionally apothecia), 21.viii.2014, *P.M. Zhurbenko s.n.* (LE 309493); **19:** on *Blastenia ammiospila* (thallus), 30.viii.2014, *M.P. Zhurbenko 14296* (LE 309616).

***Lichenochora inconspicua* Hafellner**

NOTES. – The size of the ascospores evidently varies widely in this species, as the size range of those in the specimens examined ((13.0–)19.1–29.5(–35.0) × (4.5–)5.5–7.1(–7.8) µm, l/b = (2.5–)3.0–4.8(–5.8) (n=48)), is much wider than was reported for the holotype (23–26 × 6–8 µm *fide* Hafellner 1989), larger than that reported by Zhurbenko & Thor (2013; (18–)19.5–23(–25.5) × (4.5–)5.5–7.5(–8.5) µm, l/b = (2.6–)2.9–3.9(–4.5)), and also smaller than reported by Navarro-Rosinés et al. (1998; (23.5–)25.5–37(–39) × 6–7.5(–9) µm, l/b = (3.4–)3.7–5.2(–5.7)). The species is known from various European countries (Brackel 2014), and is here newly documented for Asia and Russia.

Specimens examined (both on thalli of *Mycobilimbia berengeriana*). – **14:** 21.viii.2014, *M.P. Zhurbenko 14412* (LE 309526); 22.viii.2014, *P.M. Zhurbenko s.n.* (LE 309525).

Lichenochora lepidiotae (Anzi) Etayo & Nav.-Ros.

LITERATURE REPORTS. – **RUSSIA:** Kabardino-Balkarian Republic, Krasnodar Territory; on *Fuscopannaria praetermissa* (Etayo & Navarro-Rosinés 2008, Vainio 1899, Zhurbenko & Otte 2012).

Lichenochora cf. *lepidiotae* (Anzi) Etayo & Nav.-Ros.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Fuscopannaria praetermissa* (Zhurbenko & Kobzeva 2014).

Lichenochora obscuroides (Linds.) Triebel & Rambold

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Phaeophyscia hirsuta* (Urbanavichus & Ismailov 2013).

Lichenochora rinodinae Zhurb.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Rinodina turfacea* (Zhurbenko & Kobzeva 2014).

Lichenochora wasseri S.Y. Kondr

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Caloplaca saxicola* (Urbanavichus & Urbanavichene 2014).

Lichenochora weillii (Werner) Hafellner & R. Sant.

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, on *Physconia distorta* and *P. muscigena* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2016).

Lichenoconium aeruginosum Diederich, M. Brand, van den Boom & Lawrey

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Cladonia pyxidata* (Zhurbenko & Kobzeva 2016).

Lichenoconium cargillianum (Linds.) D. Hawksw.

NOTES. – According to Lawrey and Diederich (2017) *Pseudevernia* is a new host genus. *Lichenoconium cargillianum* was recently first documented in Russia from the Caucasus (Zhurbenko & Kobzeva 2016), and is here newly reported for the Krasnodar Territory.

Specimens examined. – **2:** on *Usnea florida* (apothecial discs), 8.viii.2014, *M.P. Zhurbenko 14376a* (LE 309570a); **17:** on *Hypogymnia physodes* (thallus), 1.ix.2014, *M.P. Zhurbenko 14242b* (LE 309578); **18:** on *Hypogymnia* sp. (thallus), 28.viii.2014, *M.P. Zhurbenko 14260b* (LE 309579b).

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Cetrelia cetrarioides* (Zhurbenko & Kobzeva 2016).

Lichenoconium erodens M.S. Christ. & D. Hawksw.

Specimens examined. – **6:** on *Evernia prunastri* (thallus), 12.viii.2014, *M.P. Zhurbenko 14302* (LE 309386); on *Hypogymnia physodes* (thallus), 15.viii.2014, *M.P. Zhurbenko 14301* (LE 309387); **9:** on *E. divaricata* (thallus), 16.viii.2014, *M.P. Zhurbenko 14485* (LE 309499); on *H. physodes* (thallus), 16.viii.2014, *M.P. Zhurbenko 14207a* (LE 309388a); on *Lecanora albella* (apothecial discs), 16.viii.2014, *M.P. Zhurbenko 14238a* (LE 309389a); **15:** on *Flavoparmelia caperata* (thallus), 2.ix.2014, *M.P. Zhurbenko 14310* (LE 309378).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Biatoropsis usnearum* agg., *Bryoria chalybeiformis*, *Cetraria islandica*, *Cetrelia olivetorum*, *Flavoparmelia caperata*, *Hypogymnia physodes*, epiphytic *Lecanora* sp., *Melanelia stygia*, *Parmeliopsis ambigua*, *Physconia distorta*, *Platismatia glauca*, *Pseudevernia furfuracea* and *Usnea* sp. (Urbanavichus & Urbanavichene 2014; Zhurbenko & Kobzeva 2014, 2016).

Lichenoconium lecanorae (Jaap) D. Hawksw.

Specimens examined. – **1:** on *Lecanora polytropa* (apothecia), 7.viii.2014, *M.P. Zhurbenko 14421* (LE 309523); 7.viii.2014, *M.P. Zhurbenko 14480* (LE 309521); **7:** on *Flavoparmelia caperata* (thallus), 13.viii.2014, *M.P. Zhurbenko 14303* (LE 309385); **15:** on *F. caperata* (thallus), 26.viii.2014, *M.P. Zhurbenko 14212* (LE 309390); **18:** on *Lecanora* sp. (apothecia), 29.viii.2014, *M.P. Zhurbenko 14460* (LE 309524); **19:** on *Cetrelia olivetorum* (thallus), 30.viii.2014, *M.P. Zhurbenko 14324a* (LE 309403a); **20:** on sterile crustose lichen (thallus) on a deciduous tree bark, 10.ix.2014, *M.P. Zhurbenko 14469* (LE 309522); **21:** on *F. caperata* (thallus), 6.ix.2014, *M.P. Zhurbenko 14320b* (LE 309394b); on *F. caperata* (thallus, often soralia), 6.ix.2014, *M.P. Zhurbenko 14259* (LE 309392).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Brodoa intestiniformis*, *Evernia prunastri*, *Lecanora carpinea*, *L. muralis*, *L. saligna*, *L. saxicola*, epiphytic *Lecanora* sp. and *Rhizoplaca chrysoleuca* (Urbanavichus & Ismailov 2013; Urbanavichus & Urbanavichene 2014; Urbanavichus et al. 2011; Zhurbenko & Kobzeva 2014, 2016; Zhurbenko & Otte 2012).

Lichenoconium pyxidatae (Oudem.) Petr. & Syd.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Cladonia chlorophaea* s. l., *C. coniocraea*, *C. pocillum*, *C. pyxidata* and *Cladonia* sp. (Urbanavichus & Urbanavichene 2014, 2015a; Zhurbenko & Kobzeva 2014; Zhurbenko & Pino-Bodas 2017).

Lichenoconium usneae (Anzi) D. Hawksw.

Specimens examined. – **8:** on *Menegazzia terebrata* (thallus), 14.viii.2014, *M.P. Zhurbenko 14308* (LE 309380); **9:** on *Usnea florida* (apothecia, moribund stem bases), 16.viii.2014, *M.P. Zhurbenko 14489* (LE 309559); 16.viii.2014, *M.P. Zhurbenko 14375* (LE 309558); **9:** on *Usnea* sp. (galls induced by an unidentified heterobasidiomycete), 16.viii.2014, *M.P. Zhurbenko 14379* (LE 309556); **18:** on *Melanelixia glabra* (apothecia), 28.viii.2014, *M.P. Zhurbenko 14309a* (LE 309379a); on *U. florida* (apothecia), 28.viii.2014, *P.M. Zhurbenko s.n.* (LE 309557a); 28.viii.2014, *M.P. Zhurbenko 14380a* (LE 309561a); 29.viii.2014, *M.P. Zhurbenko 14378b* (LE 309560).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Anaptychia ciliaris*, *Cladonia chlorophaea* s. l., *C. coniocraea*, *Physcia stellaris*, *Ramalina calicaris*, *R. subgeniculata*, *Tuckermannopsis sepincola* and *Usnea* sp. (Urbanavichus & Ismailov 2013; Urbanavichus & Urbanavichene 2014; Zhurbenko & Kobzeva 2014, 2016; Zhurbenko & Pino-Bodas 2017).

***Lichenodiplis anomala* Etayo & Pérez-Vargas**

NOTES. – The specimens examined differ slightly from the protologue (Pérez-Vargas et al. 2013) in the size and septation of the conidia ((0–)1(very rarely 2)-septate, (3.8–)4.8–6.6(–9.5) × (2.0–)2.6–3.2(–3.9) µm, l/b = (1.1–)1.6–2.4(–3.5) (n=103) for the specimens examined vs. 1-septate, 5.5–7 × 2.5–3.5 µm). Based on the very long lateral conidiogenous cells with 2–4 widely spaced annellations, the species is not typical for *Lichenodiplis* Dyko & D. Hawksw (Hawksworth & Dyko 1979). Instead it resembles *Minutoexcipula mariana* V. Atienza, a superficially similar species that is confined to *Pertusaria* species and can further be distinguished by the conidiogenous cells with 2–5 closely spaced annellations and uniformly 1-septate conidia (Atienza 2002). *Lichenodiplis anomala* was formerly known from the Canary Islands, mainland Spain and Chile (Pérez-Vargas et al. 2013), and is here newly documented for Asia and Russia.

Specimens examined (all on apothecial discs of *Ochrolechia pallescens*). – **4:** 10.viii.2014, *M.P. Zhurbenko 14384* (LE 309598); **17:** 1.ix.2014, *M.P. Zhurbenko 14390* (LE 309597); **18:** 28.viii.2014, *M.P. Zhurbenko 14391* (LE 309599); 29.viii.2014, *M.P. Zhurbenko 14396* (LE 309596); 29.viii.2014, *M.P. Zhurbenko 14497d* (LE 309595d).

Lichenodiplis lecanorae (Vouaux) Dyko & D. Hawksw.

NOTES. – Hawksworth & Dyko (1979) characterized the conidia of this species as being somewhat narrower than in the specimen examined for this study (4–7.5 × 2–3 µm vs. (5.5–)5.6–7.0(–7.7) × (2.6–)3.0–3.8(–4.3) µm, l/b = (1.3–)1.6–2.2(–2.3) (n=17) for the specimen examined).

Specimen examined. – **4:** on *Lecanora pulicaris* (apothecial discs), 10.viii.2014, *M.P. Zhurbenko 14458* (LE 309515).

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, Republic of Daghestan; on *Caloplaca pyracea*, *Caloplaca* sp., *Lecanora albella*, *L. argentata* and epiphytic *Lecanora* sp. (Urbanavichus & Urbanavichene 2014, Urbanavichus et al. 2010, Zhurbenko & Otte 2012).

Lichenopeltella cladoniarum E.S. Hansen & Alstrup

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Cladonia arbuscula* ssp. *arbuscula*, *C. arbuscula* ssp. *mitis* and *C. rangiferina* (Zhurbenko & Kobzeva 2016).

Lichenopeltella cetrariicola (Nyl.) R. Sant.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Cetraria islandica* (Zhurbenko & Kobzeva 2016).

Lichenopeltella peltigericola (D. Hawksw.) R. Sant.

NOTE. – In addition to the Caucasus, this species is known from the Murmansk Region, Karelia and Komi Republics, Krasnoyarsk and Kamchatka Territories and Chukotka Autonomous Area (Alstrup 2004; Zhurbenko 2004, 2009a, b). It is here newly reported from the the Krasnodar Territory of Russia.

Specimens examined (both on the underside of *Peltigera praetextata* lobes). – **7:** 13.viii.2014, *M.P. Zhurbenko 14349* (LE 309465); **16:** 1.ix.2014, *M.P. Zhurbenko 14343c* (LE 309480c).

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Peltigera polydactylon* agg. (Zhurbenko & Kobzeva 2014).

Lichenopeltella santessonii (P.M. Kirk & Spooner) R. Sant.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Peltigera elisabethae* (Urbanavichus & Urbanavichene 2014).

Lichenopuccinia poeltii D. Hawksw. & Hafellner

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Parmelia sulcata* (Zhurbenko & Kobzeva 2014).

Lichenosticta alcicorniaria (Linds.) D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Cladonia chlorophaea* s. l., *C. coniocraea*, *C. mitis*, *C. ochrochlora*, *C. pocillum*, *C. pyxidata* and *Cladonia* sp. (Zhurbenko & Kobzeva 2014, Zhurbenko & Pino-Bodas 2017).

Lichenostigma alpinum (R. Sant., Alstrup & D. Hawksw.) Ertz & Diederich

Specimens examined. – **1:** on sterile white crustose lichen with soralia growing on plant remnants on ground, 5.viii.2014, *M.P. Zhurbenko 14434* (LE 309588); **9:** on *Lepra albescens* (fruiting verrucae, thallus), 16.viii.2014, *M.P. Zhurbenko 14398a* (LE 309586a); **11:** on *L. albescens* (fruiting verrucae, thallus), 24.viii.2014, *M.P. Zhurbenko 14394* (LE 309587).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory; on *Flavoparmelia caperata*, *Lecanora intumescens*, *Ochrolechia* cf. *inaequatula* and terricolous *Ochrolechia* sp. (Zhurbenko & Kobzeva 2014, 2016).

***Lichenostigma chlaroterae* (F. Berger & Brackel) Ertz & Diederich**

NOTES. – Previously this species was known in Russia only from a single collection made in the Far Eastern Federal District (Zhurbenko 2014). It is newly documented for the Caucasus.

Specimen examined. – **13:** on *Lecanora pulicaris* (thallus), 18.viii.2014, *M.P. Zhurbenko 14465a* (LE 309527a).

Lichenostigma cosmopolites Hafellner & Calat.

Specimen examined. – **15:** on *Xanthoparmelia stenophylla* (apothecia, thallus), 2.ix.2014, *M.P. Zhurbenko 14322* (LE 309400).

LITERATURE REPORTS. – **GEORGIA:** host lichen not specified (Hafellner & Calatayud 1999). **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory; on *Xanthoparmelia stenophylla* and *X. tinctina* (Urbanavichus & Urbanavichene 2015a, Zhurbenko & Kobzeva 2014).

Lichenostigma elongatum Nav.-Ros. & Hafellner

LITERATURE REPORTS. – **RUSSIA:** Republic of Daghestan, Krasnodar Territory; on *Aspicilia* sp., *Circinaria calcarea* and *Lobothallia radiosa* (Urbanavichus & Urbanavichene 2015a, Urbanavichus et al. 2011).

Lichenostigma epipolina Nav.-Ros., Calat. & Hafellner

LITERATURE REPORTS. – **RUSSIA:** Republic of Daghestan, Krasnodar Territory; on *Diplotomma hedinii* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014).

Lichenostigma maureri Hafellner

NOTE. – The species is very common in the Caucasus, but still is newly reported here for the Krasnodar Territory of Russia.

Specimens examined. – **2:** on *Usnea florida* (thallus, underside of apothecia), 8.viii.2014, *M.P. Zhurbenko 14376b* (LE 309570b); **9:** on *Pseudevernia furfuracea* (thallus), 16.viii.2014, *M.P. Zhurbenko 14328a* (LE 309413a); **12:** on *P. furfuracea* (thallus), 18.viii.2014, *P.M. Zhurbenko s.n.* (LE 309414); **12:** on *U. florida* (thallus), 18.viii.2014, *P.M. Zhurbenko s.n.* (LE 309563); **17:** on *U. florida* (thallus), 31.viii.2014, *P.M. Zhurbenko s.n.* (LE 309562); **18:** on *P. furfuracea* (thallus), 29.viii.2014, *M.P. Zhurbenko 14313* (LE 309375); on *U. subfloridana* (thallus), 28.viii.2014, *M.P. Zhurbenko 14382* (LE 309564); on *U. florida* (thallus), 28.viii.2014, *M.P. Zhurbenko 14380b* (LE 309561b).

LITERATURE REPORTS. – **RUSSIA:** Kabardino-Balkarian Republic, Karachayevo-Circassian Republic, Republic of Adygeya, Republic of Daghestan; on *Evernia mesomorpha*, *Pseudevernia furfuracea*, *Ramalina calicaris*, epiphytic *Ramalina* sp., *Usnea dasypoga*, *U. intermedia* and *Usnea* spp. (Navarro-Rosinés & Hafellner 1996, Urbanavichus & Ismailov 2013, Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Lichenostigma rupicolae Fern.-Brime & Nav.-Ros.

NOTES. – The species was formerly reported from *Lepra amara*, *Pertusaria* aff. *amarescens*, *P. leucosora*, *P rupicola* (holotype), an unidentified saxicolous *Pertusaria* sp. and *Varicellaria lactea* (Etayo 2010, Fernandez-Brime et al. 2010, Zhurbenko & Kobzeva 2014, Zhurbenko et al. 2016). *Pertusaria excludens* is a new host species. In addition to the Caucasus, the species was previously known in Russia only from its Trans-Baikal Territory (Zhurbenko et al. 2016), and is here newly reported for the Republic of Adygeya.

Specimen examined. – **1:** on *Pertusaria excludens* (thallus), 7.viii.2014, *M.P. Zhurbenko 14422* (LE 309589).

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on saxicolous *Pertusaria* sp. (Zhurbenko & Kobzeva 2014).

Lichenostigma semiimmersum Hafellner

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Buellia elegans* (Urbanavichus & Ismailov 2013).

Lichenothelia renobalesiana D. Hawksw. & V. Atienza

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, Republic of Daghestan; on *Bagliettoa* spp., *Verrucaria* spp. and endolithic lichen (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014, Urbanavichus et al. 2011).

Lichenothelia rugosa (G. Thor) Ertz & Diederich

NOTE. – In addition to the Caucasus, this species was formerly known in Russia from the Murmansk Region, Komi Republic, Altai Territory and Chukotka Autonomous Area (Zhurbenko 2004, 2009a; Zhurbenko & Davydov 2000). It is here newly reported for the Republic of Adygeya.

Specimen examined. – **1:** on *Diploschistes scruposus* (thallus, occasionally apothecia), 4.viii.2014, *M.P. Zhurbenko 14419* (LE 309500).

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Diploschistes muscorum* and *D. scruposus* (Zhurbenko & Kobzeva 2014).

Marchandiomyces corallinus (Roberge) Diederich & D. Hawksw.

Specimens examined. – **9:** on *Melanohalea olivacea* (thallus), 16.viii.2014, *M.P. Zhurbenko 14206a* (LE 309422a); **13:** on *Lecanora pulicaris* (apothecia, thallus), 18.viii.2014, *M.P. Zhurbenko 14465b* (LE 309527b); **15:** on *Xanthoparmelia stenophylla* (thallus), 26.viii.2014, *M.P. Zhurbenko 14231* (LE 309421); **18:** on *Melanelixia glabra* (thallus), 29.viii.2014, *M.P. Zhurbenko 14337b* (LE 309427b); on *Melanohalea olivacea* (thallus), 29.viii.2014, *M.P. Zhurbenko 14334b* (LE 309424b); on *Parmelina quercina* (thallus), 28.viii.2014, *M.P. Zhurbenko 14314* (LE 309374); **20:** on *Flavoparmelia caperata* (thallus), 10.ix.2014, *M.P. Zhurbenko 14499* (LE 309615); on *P. tiliacea* (thallus), 10.ix.2014, *M.P. Zhurbenko 14209* (LE 309423); 10.ix.2014, *M.P. Zhurbenko 14208* (LE 309614).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya, Stavropol Territory; on *Flavoparmelia caperata*, *Montanelia tominii*, *Parmelia sulcata*, *Parmeliopsis ambigua*, *Physcia stellaris*, *Pseudevernia furfuracea*, *Ramalina* spp., *Usnea glabrescens*, *U.*

subfloridana, Vulpicida pinastri, *Xanthoparmelia stenophylla* and *Xanthoria parietina* (Otte 2007, Zhurbenko & Kobzeva 2016).

Merismatium cf. *cladoniicola* Alstrup

NOTE. – According to Zhurbenko and Pino-Bodas (2017) *Merismatium cladoniicola* might be a heterotypic synonym of *M. decolorans* (Arnold) Triebel.

LITERATURE REPORT. – **RUSSIA:** Stavropol Territory, on *Cladonia pocillum* (Zhurbenko & Kobzeva 2014).

Merismatium heterophractum (Nyl.) Vouaux

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Cladonia pyxidata* (Zhurbenko & Kobzeva 2014).

***Merismatium nigritellum* (Nyl.) Vouaux agg.**

NOTES. – This species is widely distributed in the northern hemisphere (Brackel 2014) and has also been reported from Chile (as 'aff. *nigritellum*'; Etayo & Sancho 2008). In Russia it has almost exclusively been reported from the Arctic, where it is common (Zhurbenko 2009a, b). The species has been reported from a wide range of distantly related host genera, as well as cyanobacterial films and plant remains, but according to Brackel (2014) not yet from *Bryoplaca*. It is here newly documented for the Caucasus.

Specimens examined. – **14:** on *Bryoplaca sinapisperma* (thallus) and adjacent cyanobacterial film over bryophytes, 21.viii.2014, *M.P. Zhurbenko 14456* (LE 309554); on moribund bryophytes and cyanobacterial film, 21.viii.2014, *M.P. Zhurbenko 14488* (LE 309555).

Merismatium sp.

NOTES. – Ascomata up to 200 µm in diameter, more or less superficial. Ascospores ellipsoid, (9.6–)11.9–16.5(–19.7) × (7.1–)7.8–9.2(–10.0) µm, l/b = (1.2–)1.5–1.9(–2.0) (n=27), mainly with 3–4 trans- or oblique septa and one longiseptum in central segments. Morphologically the examined material is most similar to *Merismatium nigritellum*, which has been reported on the same host lichen (e.g., Zhurbenko 2009a). However, that species has larger ascospores, (14–)15–24.5(–32) × (6.5–)8–12(–15) µm, which are often muriform (Triebel 1989).

Specimen examined. – **14:** on *Megaspora verrucosa* (thallus), 21.viii.2014, *P.M. Zhurbenko s.n.* (LE 309544).

Microcalicium arenarium (A. Massal.) Tibell

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, Karachayevo-Circassian Republic, Krasnodar Territory; host lichens not specified (Urbanavichus & Urbanavichene 2004).

Microcalicium disseminatum (Ach.) Vain.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on epiphytic crustose lichen (Otte 2004).

Milospium graphideorum (Nyl.) D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Daghestan; on *Dirina stenhammari* and sterile lichen with *Trentepohlia* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2015b).

Minutoexcipula calatayudii V. Atienza

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Hypogymnia tubulosa* (Zhurbenko & Kobzeva 2014).

***Monodictys fuliginosa* Etayo**

NOTES. – This species is known from scattered finds on *Lobaria* species throughout the northern hemisphere (Brackel 2014). In Russia, it has previously been reported from the mountains of Ural and South Siberia (Zhurbenko 2004, 2012b; Zhurbenko & Otnyukova 2001), and is here newly documented for the Caucasus.

Specimens examined. – **4:** on *Lobaria pulmonaria* (thallus), 10.viii.2014, *M.P. Zhurbenko 14366a* (LE 309539a); **5:** on *Ricasolia amplissima* (thallus), 10.viii.2014, *M.P. Zhurbenko 14367a* (LE 309538a); **11:**

on *L. pulmonaria* (thallus), 24.viii.2014, *M.P. Zhurbenko 14363* (LE 309537); **17:** on *L. pulmonaria* (thallus), 1.ix.2014, *M.P. Zhurbenko 14361b* (LE 309536b).

Muellerella erratica (A. Massal.) Hafellner & V. John

Specimens examined. – **1:** on *Bellemerea alpina* (apothecia, thallus), 7.viii.2014, *P.M. Zhurbenko s.n. & M.P. Zhurbenko 14423* (LE 309508); on *Lecanora polytropa* (thallus, occasionally apothecia), 5.viii.2014, *M.P. Zhurbenko 14441* (LE 309504); 6.viii.2014, *M.P. Zhurbenko 14429a* (LE 309507a); 7.viii.2014, *M.P. Zhurbenko 14476* (LE 309505); 7.viii.2014, *M.P. Zhurbenko 14479* (LE 309506); on *Lecidea lactea* (thallus), 4.viii.2014, *M.P. Zhurbenko 14418* (LE 309509); 5.viii.2014, *M.P. Zhurbenko 14444* (LE 309511).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Acarospora cervina*, saxicolous *Acarospora* sp., *Caloplaca variabilis*, *Caloplaca* sp. on limestone, *Circinaria calcarea*, *Lecanora agardhiana*, *Lecanora flotoviana*, epiphytic *Lecanora* sp., *Lecidella stigmatea*, *Porpidia crustulata*, *Protoblastenia incrustans*, *P. rupestris*, *Pyrenodesmia chalybaea*, *P. variabilis*, *Variospora australis* and *Rusavskia elegans* (Urbanavichus & Ismailov 2013; Urbanavichus & Urbanavichene 2014, 2015a; Urbanavichus et al. 2011; Zhurbenko & Kobzeva 2014, 2016).

Muellerella hospitans Stizenb.

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Stavropol Territory; on *Bacidia fraxinea*, *B. rubella* (Otte 2004; Urbanavichus & Urbanavichene 2014, 2015a; Zhurbenko & Kobzeva 2014, 2016).

Muellerella lichenicola (Sommerf.) D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Daghestan, Stavropol Territory; on *Acarospora veronensis*, *Aspicilia* spp., *Caloplaca cerina*, *Caloplaca* spp., *Lecanora chlarotera*, *Rinodina immersa*, *Rinodina* sp. and *Tephromela atra* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2015a, Urbanavichus et al. 2011, Zhurbenko & Kobzeva 2014).

Muellerella pygmaea (Körb.) D. Hawksw. s. l.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya, Republic of Daghestan, Republic of North Ossetia – Alania, Stavropol Territory; on *Aspicilia* spp., *Caloplaca teicholyta*, *Caloplaca* spp., *Circinaria calcarea*, *C. contorta*, *Lecanora crenulata*, *L. intricata*, *Verrucaria furfuracea* and *V. macrostoma* f. *furfuracea* (Urbanavichus & Ismailov 2013; Urbanavichus & Urbanavichene 2014, 2015a; Urbanavichus et al. 2011; Vainio 1899; Zhurbenko & Kobzeva 2014).

Muellerella pygmaea (Körb.) D. Hawksw. var. *pygmaea*

Specimens examined (both on thalli of *Lecidea lactea*). – **1:** 6.viii.2014, *M.P. Zhurbenko 14430* (LE 309512); 7.viii.2014, *M.P. Zhurbenko 14420* (LE 309510).

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Rhizocarpon* sp. (Zhurbenko & Kobzeva 2016).

Muellerella triseptata Diederich

NOTE. – This species was formerly known in Russia only from the Caucasus (see literature report below), and is here newly reported for the Krasnodar Territory.

Specimen examined. – **14:** on *Blastenia ammiospila* (thallus), 21.viii.2014, *M.P. Zhurbenko 14482* (LE 309492).

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Blastenia ammiospila* (Urbanavichus & Urbanavichene 2014).

Muellerella ventosicola (Mudd) D. Hawksw.

NOTE. – This species is common and widely distributed in Russia (Zhurbenko 2009a, b), but is here newly reported for the Krasnodar Territory.

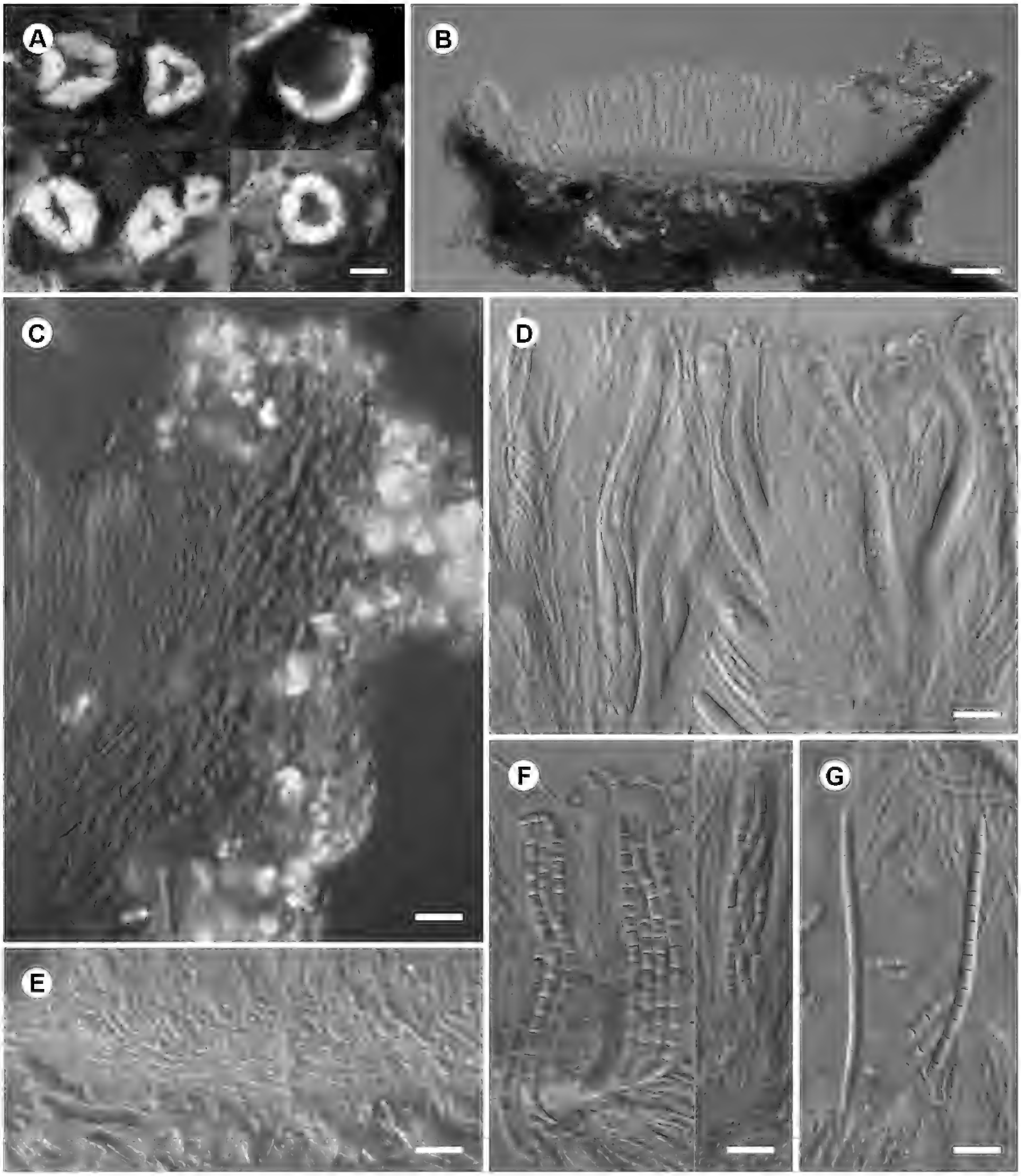

Figure 2, *Nanostictis caucasica*. A, ascomata (all from the holotype except upper right, which is from LE 309577). B, ascoma in cross section in water (holotype); note elevated remnants of the host lichen cortex surrounding the exciple. C, lateral exciple encrusted by crystals in cross section in water (LE 309577). D, paraphyses and immature asci in K/I (LE 309577). E, basal exciple above the brown hyphae of the host lichen in water (holotype). F, mature asci in I (holotype). G, ascospores in I (on the left) and in K/I (on the right) (holotype). Scale bars: A = 200 µm, B = 50 µm, C–G = 10 µm.

Specimens examined. – **1:** on *Rhizocarpon* sp. (thallus), 6.viii.2014, *M.P. Zhurbenko 14429b* (LE 309507b); **19:** on *Ophioparma ventosa* (thallus), 31.viii.2014, *M.P. Zhurbenko 14446* (LE 309552).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Rhizocarpon* spp. and *Ophioparma ventosa* (Zhurbenko & Kobzeva 2014, 2016).

Myxophora leptogiophila (G. Winter) Nik. Hoffm. & Hafellner

LITERATURE REPORT. – **GEORGIA:** on *Leptogium pseudofurfuraceum* (Hafellner 2004). **RUSSIA:** Republic of Adygeya, on *Scytinium pulvinatum* (Urbanavichus & Urbanavichene 2014).

***Nanostictis caucasica* Zhurb. sp. nov.**

MycoBank # MB 822119.

FIGURE 2

DIAGNOSIS. – Lichenicolous fungus. Morphologically similar to *Nanostictis peltigerae* but with larger apothecia up to 0.6 mm in diameter, almost constantly 4-spored vs. 6–8-spored asci, and (2–)10–16(–17)-septate vs. 3–4-septate, larger ascospores, mainly 54–74 × 3.0–3.8 µm vs. 40–60 × 0.8–1.3 µm.

TYPE: **RUSSIA.** KRASNODAR TERRITORY: Caucasian Biosphere Reserve, northern spur of Mt. Armovka, 43°53'27"N, 40°39'47"E, elev. 1830 m, *Betula litwinowii* forest at the upper boundary of the mountain forest belt, on *Parmelia sulcata* (darkened parts of lobes) growing on *Betula litwinowii*, 28.viii.2014, *M.P. Zhurbenko 14265* (LE 309576!, holotype).

DESCRIPTION. – *Ascomata* apothecia, cup- or dish-shaped, 250–600 µm in diameter, erumpent, finally to about half exposed or occasionally almost superficial; margin persistent, prominent, dull white (both dry and moistened) and grainy due to crystal depositions, roughly torn by radial cracks, crenulate, 50–200 µm thick in surface view; disc moderate orange yellow, glossy, slightly white pruinose, concave to flat, initially almost closed by the inturned margins, pore- or slit-like, later widely exposed up to 230 µm lengthways; arising singly to occasionally concrescent. *Lateral exciple* hyaline, consists of 1) an inner layer ca. 20–25 µm thick above, ca. 10 µm thick below, mainly composed of more or less tangentially elongated cells with lumina ca. 2–9 × 1–3 µm and walls up to 4 µm thick; 2) an outer layer 15–50 µm thick, composed of interwoven hyphae, sometimes partly intermixed with the hyphae of the host; outer layer covered by a layer of insoluble in K large crystals 20–80 µm thick. *Lower exciple* hyaline, 10–15(–25) µm thick, hardly distinct from subhymenium, mainly composed of isodiametric cells ca. 3–4 µm in diameter. *Epihymenium* indistinct. *Hymenium* hyaline, with occasional crystalline granules lying on its surface, (65–)70–80(–95) µm thick, I and K/I–. *Paraphyses* filiform, 1.2–1.5 µm in diameter, sometimes thickened at the apex up to 2.8 µm, occasionally with short branchlets above or forked at the apex, septate, not constricted at the septa. *Asci* subcylindrical, apex rounded, tholus 2–5 µm thick, sometimes with distinct ocular chamber, (64–)67–86(–97) × (7–)8–10.5(–11.5) µm (n=29, in water, I or K/I), 4(rarely 8)-spored, I and K/I–. *Ascospores* hyaline, homopolar, vermiform, gradually tapering to the apices, (40.0–)53.7–73.7(–88.0) × (2.7–)3.0–3.8(–4.5) µm, l/b = (12.2–)17.4–24.2(–26.7) (n=53, in water, I or K/I), (2–)10–16(–17)-septate (n=59), not constricted at the septa, smooth-walled, non-halonate, not protruding above the hymenium, arranged in the ascus in a bundle.

DISTRIBUTION AND HOST. – The new species is known from two specimens collected at the same locality in the Caucasus, where it was found in a subalpine *Betula* forest growing on darkened portions of lobes of epiphytic *Parmelia sulcata*. Distinct pathogenicity not observed, but infections were associated with darkened portions of the host thalli.

DISCUSSION. – Morphologically the new species is quite similar to *Nanostictis peltigerae* M.S. Christ., the type species of the lichenicolous genus *Nanostictis* M.S. Christ., including such characters as the hyaline exciple and I and K/I– hymenium and asci (Christiansen 1954). However, it clearly differs from *N. peltigerae* in having larger apothecia (up to 0.6 mm in diameter vs. up to 0.3 mm in diameter), thick depositions of crystals on apothecial margins, almost constantly 4-spored asci (vs. 6–8-spored asci), (2–)10–16(–17)-septate (vs. 3–4-septate) ascospores that are larger ((40.0–)53.7–73.7(–88.0) × (2.7–)3.0–3.8(–4.5) µm vs. 40–60 × 0.8–1.3 µm in *N. peltigerae*), and in the different host (*Parmelia* in the Lecanorales vs. *Peltigera* in the Peltigerales). Each of the six known species of *Nanostictis* is restricted to a

particular host genus of Peltigerales (Lawrey & Diederich 2017). Among these, *N. caucasica* is most reminiscent of *N. stictae* Etayo, which has ascospores that are similar in size and septation (i.e., 9–15-septate, 42–80 × 3.5–5.5 µm; Etayo 2002). However, the latter differs in having a K/I+ blue, taller hymenium (90–110 µm tall), larger asci (77–110 × 12–18 µm), somewhat wider, heteropolar ascospores that gradually taper towards the base, and a different host genus (*Sticta*; Etayo 2002).

Additional specimen examined. – Same locality and habitat as for the holotype, on *Parmelia sulcata* (darkened parts of lobes) growing on *Betula litwinowii*, 29.viii.2014, *M.P. Zhurbenko 14493* (LE 309577).

Nectriopsis lecanodes (Ces.) Diederich & Schroers

NOTE. – In addition to the Caucasus, this species was formerly known in Russia from the Leningrad Region, Komi Republic, Republic of Tuva, Altai Territory and Republic of Sakha (Yakutia) (Zhurbenko 2004, 2009b; Zhurbenko & Davydov 2000; Zhurbenko & Otnyukova 2001; Zhurbenko & Vershinina 2014). It is here newly reported for the Krasnodar Territory and Republic of Adygeya.

Specimens examined. – **7:** on *Peltigera praetextata* (discolored parts of lobes), 13.viii.2014, *M.P. Zhurbenko 14347* (LE 309460); 13.viii.2014, *M.P. Zhurbenko 14343* (LE 309456); **8:** on *P. praetextata* (discolored parts of lobes), 14.viii.2014, *M.P. Zhurbenko 14356c* (LE 309454c); 14.viii.2014, *M.P. Zhurbenko 14344a* (LE 309455a); **11:** on *Nephroma parile* (discolored parts of lobes) 24.viii.2014, *A.A. Kobzeva 1448* (LE 309459); **16:** on *P. polydactylon* agg. (discolored parts of lobes), 27.viii.2014, *M.P. Zhurbenko 14346* (LE 309458); **17:** on *P. praetextata* (discolored parts of lobes), 1.ix.2014, *M.P. Zhurbenko 14345* (LE 309457); **18:** on *Lobaria scrobiculata* (discolored parts of lobes), 28.viii.2014, *M.P. Zhurbenko 14369a* (LE 309535a); 29.viii.2014, *M.P. Zhurbenko 14368* (LE 309534).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Daghestan; on *Peltigera canina*, *P. elisabethae*, *P. horizontalis*, *P. membranacea* and *P. polydactylon* (Urbanavichus & Ismailov 2013, Zhurbenko & Kobzeva 2014).

Neobarya peltigerae Lowen, Boqueras & Gomez-Bolea

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Peltigera polydactylon* (Zhurbenko & Kobzeva 2014).

Neocoleroa lichenicola (Hansf.) M.E. Barr ssp. *bouteillei* (Bricaud, Cl. Roux & Sérus.) M.E. Barr

LITERATURE REPORT. – **REPUBLIC OF ABKHAZIA:** on *Fellhanera bouteillei* (Matzer 1996).

Nesolechia oxyspora (Tul.) A. Massal.

NOTES. – Based on data reported by Brackel (2014) *Parmelia submontana* is a new host for this species. *Nesolechia oxyspora* is common and widely distributed in Russia (Zhurbenko 2009a), but is here newly reported for the Krasnodar Territory.

Specimens examined. – **2:** on *Parmelia sulcata* (thallus), 8.viii.2014, *M.P. Zhurbenko 14311a* (LE 309377a); **4:** on *P. sulcata* (thallus), 10.viii.2014, *M.P. Zhurbenko 14269a* (LE 309405a); on *P. submontana* (thallus), 10.viii.2014, *M.P. Zhurbenko 14316* (LE 309372); **18:** on *Melanelixia glabra* (thallus), 28.viii.2014, *M.P. Zhurbenko 14235* (LE 309401); 29.viii.2014, *M.P. Zhurbenko 14337a* (LE 309427a); on *P. sulcata* (thallus), 27.viii.2014, *M.P. Zhurbenko 14305b* (LE 309383b); 28.viii.2014, *M.P. Zhurbenko 14325b* (LE 309409b); 29.viii.2014, *M.P. Zhurbenko 14267c* (LE 309407c); 29.viii.2014, *M.P. Zhurbenko 14336b* (LE 309426b).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Parmelia barrenoae*, *P. saxatilis*, *P. sulcata*, *Platismatia glauca* and *Xanthoparmelia stenophylla* (Otte 2007, Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Niesslia cladoniicola D. Hawksw. & W. Gams

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Cladonia chlorophaea* s. l. and *C. coniocraea* (Zhurbenko & Kobzeva 2016).

Niesslia peltigericola (D. Hawksw.) Etayo

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Peltigera* sp. (Urbanavichus & Urbanavichene 2014).

Odontotrema thamnoliae Zhurb., Diederich & Etayo

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Thamnolia vermicularis* var. *subuliformis* (Zhurbenko & Kobzeva 2014).

Opegrapha anomea Nyl.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory; on *Lepra amara* and *Ochrolechia trochophora* (Urbanavichene & Urbanavichus 2014, Zhurbenko & Kobzeva 2014).

Opegrapha pulvinata Rehm

LITERATURE REPORTS. – **RUSSIA:** Republic of Daghestan, on *Endocarpon pusillum* and *Placidium* sp. (Urbanavichus & Ismailov 2013, Urbanavichus et al. 2011).

Opegrapha rotunda Hafellner

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, on *Physconia distorta* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014).

Opegrapha rupestris Pers.

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Bagliettoa* spp. and *Verrucaria* spp. (Urbanavichus & Ismailov 2013).

Paranectria oropensis (Ces.) D. Hawksw. & Piroz.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Cetrelia olivetorum* and *Nephroma parile* (Zhurbenko & Kobzeva 2014).

Perigrapha superveniens (Nyl.) Hafellner

NOTE. – This species was formerly known in Russia only from the Caucasus (see literature report below), and is here newly reported for the Krasnodar Territory.

Specimen examined. – **18:** on *Parmelia sulcata* (thallus), 29.viii.2014, *M.P. Zhurbenko 14232* (LE 309406).

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Parmelia sulcata* (Zhurbenko & Otte 2012).

Phacopsis cephalodioides (Nyl.) Triebel & Rambold

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Hypogymnia physodes* (Zhurbenko & Kobzeva 2014).

Phacopsis cf. *usneae* C.W. Dodge

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Usnea dasypoga* (Zhurbenko & Kobzeva 2014).

Phaeopyxis punctum (A. Massal.) Rambold, Triebel & Coppins

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Cladonia cenotea* (Zhurbenko & Kobzeva 2016).

Phoma epiphyscia Vouaux

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Physcia caesia* (Zhurbenko & Kobzeva 2016).

Phoma cf. *epiphyscia* Vouaux

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Anaptychia ciliaris* (Zhurbenko & Kobzeva 2014).

Phoma lobariae Diederich & Etayo

NOTE. – This species was formerly known in Russia only from the Chukotka Autonomous Area (Zhurbenko & Braun 2013), and is here newly documented for the Russian Caucasus.

Specimen examined. – **11:** on *Lobaria pulmonaria* (moribund bases of lobes), 24.viii.2014, *M.P. Zhurbenko 14364* (LE 309533).

LITERATURE REPORT. – **REPUBLIC OF ABKHAZIA:** on *Lobaria pulmonaria* (Urbanavichus & Urbanavichene 2012).

Phoma peltigerae (P. Karst.) D. Hawksw.

NOTES. – The conida in the specimen examined were oblong to occasionally ellipsoid, with rounded apices, and slightly smaller than those reported by Hawksworth (1981) ((3.6–)3.9–4.7(–5.5) × 1.9–2.3(–2.5) µm, l/b = (1.8–)1.9–2.3(–2.5) (n=29) vs. (4–)4.5–6(–7) × 2–2.5(–3) µm). In the specimen examined the lichenicolous fungus was also strongly pathogenic. In addition to the Caucasus, the species was formerly known in Russia from the Murmansk Region, Republic of Karelia, Tula Region, Krasnoyarsk Territory and Republic of Sakha (Yakutia) (Alstrup et al. 2005, Zhurbenko 2009b, Zhurbenko & Gudovicheva 2013, Zhurbenko & Vershinina 2014), and is here newly reported for the Republic of Adygeya.

Specimen examined. – **7:** on *Peltigera praetextata* (bleached parts of lobes), 13.viii.2014, *M.P. Zhurbenko 14348* (LE 309463).

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Peltigera* sp. (Zhurbenko & Kobzeva 2014).

Phoma cf. *physciicola* Keissl.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Anaptychia ciliaris* (Zhurbenko & Kobzeva 2014).

Phoma sp. 1

NOTES. – The only *Phoma* species reported on *Evernia* is *P. everniae* D. Hawksw., a species so far only known from two collections from England and Germany (Hawksworth 1994, Brackel 2014). The examined material differs from this species in having bluish green (vs. brown) pycnidial walls and shorter conidia ((3.0–)3.1–3.5(–3.6) × 1.4–1.6 µm, l/b = (2.0–)2.1–2.3(–2.5) (n=16) vs. 4.5–5 × 1–1.5 µm *fide* Hawksworth 1994). It also resembles *Phoma dubia* (Linds.) Sacc. & A. Trotter, which occurs on *Usnea* species and has similarly sized conidia (3.5 × 1.5–2 µm *fide* Hawksworth 1981; or 3 × 1.3 µm *fide* Berger & Priemetzhofer 2008), but differs in having subhyaline to golden-brown pycnidial walls (Hawksworth 1981).

Specimen examined. – **8:** on *Evernia prunastri* (thallus), 14.viii.2014, *M.P. Zhurbenko 14329b* (LE 309418b).

Phoma sp. 2

NOTES. – Conidiomata 50–75 µm in diameter, erumpent in the ostiolar area; wall pale to medium brown, markedly darker around the ostiole. Conidia hyaline, subglobose, broadly ellipsoid, broadly oblong or ovoid, (3.6–)3.9–4.9(–5.9) × (2.8–)3.3–3.9(–4.3) µm, l/b = 1.0–1.4(–1.8) (n=52), smooth-walled, with large lipid droplet. Locally common on *Flavoparmelia caperata*, causes strong local bleaching. The examined material is reminiscent of *Phoma caperatae* Vouaux, but application of this name remains uncertain due to the loss of the original material (Hawksworth 1981). The fungus does not fit the other *Phoma* species formerly reported on this host lichen, viz. *P. cladoniicola* Diederich, Kocourk. & Etayo (Lawrey et al. 2012) and *P. lecanorina* Diederich (Etayo 1996), and cannot be identified using the key to the lichenicolous species of *Phoma* presented in Hawksworth & Cole (2004).

Specimens examined. – **9:** on *Hypogymnia physodes* (thallus), 16.viii.2014, *M.P. Zhurbenko 14207b* (LE 309388b); **21:** on *Flavoparmelia caperata* (thallus), 6.ix.2014, *M.P. Zhurbenko 14320a* (LE 309394a); on *F. caperata* (thallus), 6.ix.2014, *M.P. Zhurbenko 14210*; on *F. caperata* (thallus), 6.ix.2014, *M.P. Zhurbenko 14229*.

Plectocarpon lichenum (Sommerf.) D. Hawksw.

Specimens examined (all on thalli of *Lobaria pulmonaria*). – **5:** 10.viii.2014, *M.P. Zhurbenko 14365a* (LE 309529a); **6:** 12.viii.2014, *M.P. Zhurbenko 14371* (LE 309531); **7:** 13.viii.2014, *M.P. Zhurbenko 14373a* (LE 309532a); **11:** 24.viii.2014, *M.P. Zhurbenko 14372* (LE 309528); **16:** 1.ix.2014, *M.P. Zhurbenko 14360* (LE 309530).

LITERATURE REPORTS. – **REPUBLIC OF ABKHAZIA:** on *Lobaria pulmonaria* (Urbanavichus & Urbanavichene 2012). **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *L. pulmonaria* (Otte 2007, Urbanavichene & Urbanavichus 2014, Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Plectocarpon peltigerae Zhurb., Ertz, Diederich & Miądl.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Peltigera leucophlebia* (Urbanavichus & Urbanavichene 2014).

Plectocarpon scrobiculatae Diederich & Etayo

LITERATURE REPORTS. – **REPUBLIC OF ABKHAZIA:** on *Lobaria scrobiculata* (Urbanavichus & Urbanavichene 2012). **RUSSIA:** Krasnodar Territory, on *L. scrobiculata* (Urbanavichene & Urbanavichus 2014, 2016).

Polycoccum arnoldii (Hepp) D. Hawksw.

NOTE. – This species was formerly known in Russia only from the Caucasus (see literature report below), and is here newly reported for the Krasnodar Territory.

Specimen examined. – **14:** on *Diploschistes muscorum* (thallus), 21.viii.2014, *M.P. Zhurbenko 14483* (LE 309495).

LITERATURE REPORT. – **RUSSIA:** Stavropol Territory, on *Diploschistes muscorum* (Zhurbenko & Kobzeva 2014).

***Polycoccum hymeniicola* (Berk. & Broome) Zhurb.**

NOTES. – The examined material fits well the species description published by Zhurbenko and Dillman (2010), including the presence of a presumable pycnidial anamorph with pale brown, smooth-walled conidia that mesure (9.0–)9.7–11.9(–12.9) × (5.5–)5.9–7.3(–8.2) µm, l/b = (1.2–)1.4–2.0(–2.3) (n=13). It is noteworthy that pigmentation of the ascospores and conidia is sometimes more intensive at the apices. The species was formerly known from a few finds in Central America (Panama?: Hawksworth 2005), North America (Alaska: Spribille et al. 2010, Zhurbenko & Dillman 2010) and Asia (Japan: Zhurbenko et al. 2015a), and is here newly documented for Russia.

Specimen examined. – **7:** on *Lobaria pulmonaria* (bleached parts of lobes), 13.viii.2014, *M.P. Zhurbenko 14370a* (LE 309540a).

Polycoccum marmoratum (Kremp.) D. Hawksw.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Verrucaria* sp. (Urbanavichus & Urbanavichene 2014).

Polycoccum pulvinatum (Eitner) R. Sant.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya, Stavropol Territory; on *Physcia aipolia* and *P. caesia* (Zhurbenko & Kobzeva 2014, 2016).

Polycoccum rinodinae van den Boom

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Rinodina oxydata* (Urbanavichus & Urbanavichene 2015b).

Pronectria echinulata Lowen

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Physcia aipolia* (Zhurbenko & Kobzeva 2014).

***Pronectria erythrinella* (Nyl.) Lowen s. l.**

NOTES. – There are some discrepancies between the specimens examined and the species description published by Rossman et al. (1999). In the specimens examined the ascomata are pale brown (in the exposed part), with the wall pigments not changing color in K and lactic acid (vs. red to orange, fading to yellow), the ascospores are hyaline, ellipsoid/obovate to narrowly ellipsoid/obovate (vs. at first hyaline to pale yellow, then pale orange, ellipsoid-fusiform), slightly smaller ((12.7–)15.6–18.2(–20.0) × (4.1–)5.4–6.8(–7.5) µm, l/b = (2.2–)2.4–3.2(–4.8) (n=66) vs. (17–)18–20(–30) × (4–)5.5–6(–8) µm) and

variably 0–1-septate (vs. 1-septate). Nonetheless, according to Zhurbenko (2009b), ascospores of this species significantly vary in the above characters. The species is widely distributed in Russia (Zhurbenko 2009b), but is here newly documented for the Caucasus.

Specimens examined (all on bleached parts of *Peltigera praetextata* lobes). – **6:** 12.viii.2014, *M.P. Zhurbenko 14340* (LE 309473); **7:** 13.viii.2014, *M.P. Zhurbenko 14341* (LE 309472); **8:** 14.viii.2014, *M.P. Zhurbenko 14342* (LE 309471); 14.viii.2014, *M.P. Zhurbenko 14344b* (LE 309455b); **16:** 27.viii.2014, *M.P. Zhurbenko 14339* (LE 309470).

Pronectria robergei (Mont. & Desm.) Lowen (syn. *Illosporium carneum* Fr.)

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Peltigera polydactylon* agg. and *P. praetextata* (Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Pronectria santessonii (Lowen & D. Hawksw.) Lowen

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Anaptychia ciliaris* (Zhurbenko & Kobzeva 2014).

Pseudoseptoria usneae (Vouaux) D. Hawksw.

NOTE. – This species was formerly known in Russia from the Caucasus (see literature reports below) and Irkutsk Region (Zhurbenko & Vershinina 2014), and is here newly reported for the Krasnodar Territory.

Specimen examined (both on young and old branches of *Usnea subfloridana*). – **17:** 31.viii.2014, *P.M. Zhurbenko s.n.* (LE 309568); **18:** 29.viii.2014, *M.P. Zhurbenko 14381* (LE 309569).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Usnea dasypoga*, *U. lapponica* and *Usnea* sp. (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014).

Pyrenidium actinellum Nyl. s. l.

Specimens examined. – **1:** on *Megaspora verrucosa* (thallus), 5.viii.2014, *M.P. Zhurbenko 14439* (LE 309542); **8:** on *Peltigera praetextata* (lobes), 14.viii.2014, *M.P. Zhurbenko 14356a* (LE 309454a); **15:** on *P. elisabethae* (lobes), 2.ix.2014, *M.P. Zhurbenko 14352* (LE 309469); **16:** on *P. elisabethae* (lobes), 1.ix.2014, *M.P. Zhurbenko 14359* (LE 309468).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Diploschistes scruposus*, *Leptogium lichenoides*, *Megaspora verrucosa*, *Peltigera collina*, *P. elisabethae*, *P. rufescens* and *Solorina crocea* (Otte 2004; Urbanavichene & Urbanavichus 2014; Zhurbenko & Kobzeva 2014, 2016).

Pyrenochaeta xanthoriae Diederich

LITERATURE REPORT. – **RUSSIA:** Stavropol Territory, on *Xanthoria parietina* (Zhurbenko & Kobzeva 2014).

Pyrenochaeta cf. *xanthoriae* Diederich

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Rusavskia elegans* (Zhurbenko & Kobzeva 2016).

Raesenenia huuskonenii (Räsänen) D. Hawksw., Boluda & H. Lindgr.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Bryoria americana*, *B. capillaris*, *B. fuscescens*, *Bryoria* spp. and an unspecified host lichen (Urbanavichene & Urbanavichus 2014; Urbanavichus & Urbanavichene 2004, 2014; Zhurbenko & Kobzeva 2014, 2016).

Reconditella physconiarum Hafellner & Matzer

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Physconia distorta* (Zhurbenko & Kobzeva 2014).

'*Rhabdospora lecanorae* Vouaux'

DESCRIPTION. – *Vegetative hyphae* 2.0–4.2 µm in diameter, abundant. *Pycnidia* broadly ovoid to subglobose, sometimes indistinctly papillate, 55–90 µm in diameter, with ostiole up to 25 µm in diameter, almost entirely immersed, protruding only in the ostiolar region, dispersed. Upper part of *exciple* medium to dark brown or occasionally partly red above, 8–18 µm thick, composed of elongate cells (7.3–)7.9–14.3(–19.3) × (1.8–)2.3–3.1(–3.6) µm (n=20, in water or K) with protruding free apices; lower part of exciple hyaline, 6–8 µm thick, composed of 2–3 layers of cells, measuring (3.0–)3.4–4.8(–5.3) × (1.8–)2.0–3.0(–3.3) µm (n=23, in water or K). *Conidiogenous cells* lining lower part of conidioma, enteroblastic, pyriform, elongate-ampulliform to lageniform, (5.8–)6.8–8.8(–10.2) × (2.8–)3.1–4.3(–4.9) µm (n=26, in water or K). *Conidia* hyaline, narrowly falcate, narrowly sigmoid or vermiform, tapering at each end, (22.0–)26.6–33.8(–40.0) × (2.0–)2.1–2.5(–2.9) µm, l/b = (7.6–)11.6–15.2(–18.2) (n=59; length refers to the distance between the ends of conidia), aseptate, smooth-walled, guttulate. Heavy infections cause discoloration or darkening of the hymenium.

NOTES. – According to Hawksworth (1981: 85) this name refers to the anamorph of *Lecanora pulicaris*. However, the discoloration or darkening of the host hymenium observed in the examined material is confusing and this assumption should be verified by molecular data.

Specimen examined. – **4:** on *Lecanora pulicaris* (apothecial discs), 10.viii.2014, *M.P. Zhurbenko 14470b* (LE 309518b).

Rhagadostoma lichenicola (De Not) Keissl.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Solorina crocea* (Zhurbenko & Kobzeva 2014).

***Rhizocarpon* cf. *ochrolechiae* (Poelt & Nimis) Hafellner**

NOTES. – There are several major differences between the specimen examined and the protologue (Nimis & Poelt 1987: 205), where the epihymenium was reported being dark purple, intensified in K (vs. dark bluish green, K–), the hypothecium reported to be dark red (vs. dark brown, K–), and the ascospores reported to be somewhat narrower (ca. 18–27 × 10–12.5 µm vs. (18.6–)19.9–25.1(–28.0) × (10.8–)11.6–14.4(–16.5) µm, l/b = (1.4–)1.5–1.9(–2.2) (n=32)). The only other species of *Rhizocarpon* known to grow on *Ochrolechia parella* is *R. vorax* Poelt & Hafellner (Lawrey & Diederich 2017). It differs from the examined material in having dark purple-brown, K+ dark olive (vs. dark bluish green, K–) epihymenium, hyaline (vs. pale to partly medium grayish red or red) hymenium, and larger muriform ascospores (28–33 × 15–21 µm, with 8–15 cells in optical section vs. submuriform, with (2−)3–4(–5) trans- or oblique septa and 1(–2) longisepta in central segments, (4–)6–9(–11) cells in optical section) (Poelt & Hafellner 1982). The species was formerly known from scattered reports in Macaronesia, Sardinia and British Isles, always growing on *Ochrolechia parella* (Fletcher et al. 2009, Kalb & Hafellner 1992, Nimis & Poelt 1987).

Specimen examined. – **1:** on *Ochrolechia parella* (thallus), 5.viii.2014, *M.P. Zhurbenko 14433* (LE 309605).

Rhymbocarpus neglectus (Vain.) Diederich & Etayo

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Lepraria* sp. (Zhurbenko & Kobzeva 2014).

Roselliniella cladoniae (Anzi) Matzer & Hafellner

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Cladonia coniocraea* and *C. pyxidata* (Zhurbenko & Kobzeva 2016).

***Roselliniopsis tartaricola* (Leight.) Matzer**

NOTE. – This species was previously known from Europe, the Canary Islands and North America (Brackel 2014). It is here newly documented for Asia and Russia.

Specimens examined. – **17:** on *Lepra albescens* (thallus), 31.viii.2014, *P.M. Zhurbenko s.n.* (LE 309593b); **18:** on *Ochrolechia pallescens* (thallus), 28.viii.2014, *M.P. Zhurbenko 14386a* (LE 309603a); on *O. pallescens* (thallus), 29.viii.2014, *M.P. Zhurbenko 14497c* (LE 309595c).

Sclerococcum epicladonia Zhurb.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Cladonia chlorophaea* (Zhurbenko & Pino-Bodas 2017).

Sclerococcum serusiauxii Boqueras & Diederich

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Parmelina quercina* and *P. tiliaceae* (Zhurbenko & Kobzeva 2016).

Sclerococcum simplex D. Hawksw.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on epiphytic *Pertusaria* sp. (Zhurbenko & Otte 2012).

***Scutula epiblastematica* (Wallr.) Rehm** (mesoconidial state)

NOTE. – This species was formerly known in Russia from the Murmansk and Leningrad Regions, Krasnoyarsk Territory, Republic of Altai and Republic of Sakha (Yakutia) (Himelbrant et al. 2013, Zhurbenko 2009b, Zhurbenko & Davydov 2000, Zhurbenko & Vershinina 2014), and is here newly documented for the Caucasus.

Specimen examined. – **19:** on *Peltigera canina* (lobes), 31.viii.2014, *M.P. Zhurbenko 14353* (LE 309464).

Skyttella mulleri (Willey) D. Hawksw. & R. Sant.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Peltigera* sp. (Zhurbenko & Kobzeva 2014).

Sphaerellothecium abditum Triebel

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Lecidea atrobrunnea* (Zhurbenko & Kobzeva 2016).

***Sphaerellothecium araneosum* (Arnold) Zopf**

NOTE. – This species is very common and widely distributed in the Russian Arctic (see for instance: Zhurbenko 2001, 2009b; Zhurbenko & Santesson 1996), and is here newly documented for the Caucasus from alpine habitats.

Specimens examined (both on sterile thalli resembling *Ochrolechia upsaliensis*). – **1:** 5.viii.2014, *M.P. Zhurbenko 14437* (LE 309601); 7.viii.2014, *M.P. Zhurbenko 14317* (LE 309371).

Sphaerellothecium cladoniae (Alstrup & Zhurb.) Hafellner

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Republic of Daghestan, Stavropol Territory; on *Cladonia coccifera*, *C. pocillum*, *C. pyxidata* and *Cladonia* sp. (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014, Urbanavichus et al. 2011, Zhurbenko & Kobzeva 2014, Zhurbenko & Pino-Bodas 2017).

Sphaerellothecium cf. *gowardii* Alstrup & M.S. Cole

LITERATURE REPORT. – **RUSSIA:** Stavropol Territory, on *Placidium squamulosum* (Zhurbenko & Kobzeva 2014).

Sphaerellothecium propinquellum (Nyl.) Cl. Roux & Triebel

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on apothecia of *Lecanora carpinea* (Urbanavichus & Urbanavichene 2014).

Sphaerellothecium thamnoliae Zhurb. var. *thamnoliae*

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Thamnolia vermicularis* var. *subuliformis* (Zhurbenko & Kobzeva 2014).

Sphinctrina anglica Nyl.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Protoparmelia oleagina* (Urbanavichus & Urbanavichene 2014).

***Sphinctrina leucopoda* Nyl.**

NOTE. – This species was formerly known in Russia from the Primorye Territory and Sakhalin Region (Titov 2006), and is here newly documented for the Caucasus.

Specimen examined. – **20:** on *Pertusaria hymenea* (thallus), 10.ix.2014, *M.P. Zhurbenko 14472* (LE 309607).

Sphinctrina tubaeformis A. Massal.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Pertusaria pertusa* (Urbanavichus & Urbanavichene 2015b).

Sphinctrina turbinata (Pers.: Fr.) De Not.

Specimen examined. – **1:** on saxicolous *Pertusaria* sp. (thallus), 5.viii.2014, *M.P. Zhurbenko 14443* (LE 309606).

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, Krasnodar Territory, on *Pertusaria* spp. (Otte 2004, Titov 2006).

Sporidesmiella physconiicola Zhurb., U. Braun & Kobzeva

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Physconia distorta* (Zhurbenko & Kobzeva 2016, Zhurbenko et al. 2015b).

Stigmidium buelliae Zhurb. & Himelbrant

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Buellia disciformis* (Zhurbenko & Otte 2012).

Stigmidium cerinae Cl. Roux & Triebel

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Caloplaca* sp. (Urbanavichus & Urbanavichene 2015a).

Stigmidium clauzadei Cl. Roux & Nav.-Ros.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Verrucaria nigrescens* (Urbanavichus & Urbanavichene 2015b).

Stigmidium congestum (Körb.) Triebel

Specimen examined. – **9:** on *Lecanora pulicaris* (apothecial discs), 16.viii.2014, *M.P. Zhurbenko 14466* (LE 309519).

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, Republic of Daghestan; on *Lecanora chlarotera*, *L. pulicaris*, *L. rugosella* and epiphytic *Lecanora* sp. (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014, Zhurbenko & Otte 2012).

'*Stigmidium*' *eucline* (Nyl.) Vězda

DESCRIPTION. – *Vegetative hyphae* abundantly developed, olive brown, branched, (3.0–)4.8–8.2(–9.4) µm in diameter (n=54), with smooth walls ca. 1–1.5 µm thick, septate, constricted at the septa, woven into a dense stroma-like tissue surrounding ascomata, occasionally disintegrating into 1–5-celled pieces, probably being vegetative diaspores. *Ascomata* up to 125 µm in diameter, tightly aggregated in swollen blackish heaps up to 1 mm in diameter; wall moderate olive brown, becoming yellowish or orangish brown in K. When such heaps fall, in their place on the host thallus remain pits; otherwise pathogenicity not observed. The interior of the ascomata filled with abundant, hyaline, frequently septate, branched, (1.2–)2.1–3.9(–4.9) µm (n=32) thick interascal filaments resembling parenchyma. *Asci* elongate clavate, with long foot, thick tholus and distinct ocular chamber, (40–)43–57(–64) × (12–)14–18(–19) µm (n=13), 8-spored, K/I–, BCr–. *Ascospores* initially hyaline and smooth-walled, occasionally becoming pale to medium brown and verruculose under maturation, narrowly soleiform (obskittle-shaped), (10.4–)13.6–16.2(–18.2) × (4.0–)4.5–5.9(–7.0) µm, l/b = (2.3–)2.6–3.2(–3.7) (n=97), 1-septate, not constricted at the septum, usually with 1–2 large guttules in each cell (better seen in K), non-halonate, BCr–.

NOTE. The species was formerly known in Russia from the Caucasus (see literature report below), Krasnoyarsk and Trans-Baikal Territories (Zhurbenko 2009b, Zhurbenko & Yakovchenko 2014), and is here newly reported for its Krasnodar Territory.

Specimens examined. – **1:** on *Varicellaria lactea* (thallus), 5.viii.2014, *M.P. Zhurbenko 14438* (LE 309585); **3:** on *V. lactea* (thallus), 9.viii.2014, *M.P. Zhurbenko 14400* (LE 309583); **11:** on *V. hemisphaerica* (thallus), 24.viii.2014, *M.P. Zhurbenko 14401* (LE 309582); **19:** on *V. lactea* (thallus), 31.viii.2014, *M.P. Zhurbenko 14393* (LE 309581).

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Varicellaria hemisphaerica* (Urbanavichus & Urbanavichene 2014).

Stigmidium frigidum (Sacc.) Alstrup & D. Hawksw.

Specimen examined. – **1:** on *Thamnolia vermicularis* var. *subuliformis* (thallus), 6.viii.2014, *M.P. Zhurbenko 14425* (LE 309550).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Thamnolia vermicularis* var. *subuliformis* (Zhurbenko & Kobzeva 2014, 2016).

Stigmidium hafellneri Zhurb.

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Cetraria islandica* (Zhurbenko & Kobzeva 2016).

Stigmidium lecidellae Triebel, Cl. Roux & Le Coeur

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Lecidella elaeochroma* (Urbanavichus & Urbanavichene 2014).

Stigmidium microspilum (Körb.) D. Hawksw.

NOTES. – In the most complete description of this species known to the author, the ascospores of *Stigmidium microspilum* were characterized as hyaline and ca. 14–19 × 3–5 µm in size (Keissler 1930). In the specimens examined the ascospores were mainly hyaline and smooth-walled, occasionally becoming pale brown and granulose when old, with a slightly larger size range ((12.6–)14.5–18.9(–22.0) × (3.2–)3.7–4.5(–5.0) µm, l/b = (3.2–)3.5–4.7(–5.3) (n=40)), (0–)1(–3)-septate and non-halonate. The species is known in Russia only from the Caucasus.

Specimens examined (both on thalli of *Graphis scripta*). – **20:** 10.ix.2014, *M.P. Zhurbenko 14474* (LE 309502); **21:** 6.ix.2014, *M.P. Zhurbenko 14387* (LE 309503).

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Graphis scripta* (Otte 2007, Urbanavichene & Urbanavichus 2016).

Stigmidium mycobilimbiae Cl. Roux, Triebel & Etayo

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Bilimbia sabuletorum* (Urbanavichus & Urbanavichene 2014).

Stigmidium peltideae (Vain.) R. Sant.

LITERATURE REPORT. – **RUSSIA:** Kabardino-Balkarian Republic, on *Peltigera aphthosa* (Vainio 1899).

***Stigmidium pseudopeltideae* Cl. Roux & Triebel**

NOTE. – This species is widely distributed in Russia (Zhurbenko 2009b), but still newly documented here for the Caucasus.

Specimen examined. – **3:** on *Peltigera leucophlebia* (moribund parts of lobes), 9.viii.2014, *M.P. Zhurbenko 14358b* (LE 309466b).

Stigmidium pumilum (Lettau) Matzer & Hafellner

Specimen examined. – **9:** on *Physcia caesia* (lobes), 16.viii.2014, *M.P. Zhurbenko 14304* (LE 309384).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Physcia caesia* and *P. phaea* (Urbanavichus & Urbanavichene 2014; Zhurbenko & Kobzeva 2014, 2016).

Stigmidium rouxianum Calat. & Triebel

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, Republic of Daghestan; on *Acarospora cervina* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2014, Urbanavichus et al. 2011).

Stigmidium schaereri (A. Massal.) Trevis.

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Lecanora chlarotera* (Otte 2004).

Stigmidium solorinarium (Vain.) D. Hawksw.

Specimen examined. – **3:** on *Solorina saccata* (lobes), 9.viii.2014, *M.P. Zhurbenko 14146* (LE 264487).

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Solorina* sp. (Zhurbenko & Kobzeva 2016).

***Stigmidium squamariae* (B. de Lesd.) Cl. Roux & Triebel**

NOTE. – This species was formerly known in Russia from the Smolensk Region (identification uncertain), Tver Region, Republic of Sakha (Yakutia), Chukotka Autonomous Area and Kamchatka Territory (identification uncertain) (Notov et al. 2011, Zhurbenko 2009b, Zhurbenko & Zhdanov 2013, Zhurbenko et al. 2012b), and is here newly documented for the Caucasus.

Specimen examined. – **13:** on *Lecanora polytropa* (apothecial discs), 18.viii.2014, *M.P. Zhurbenko 14477* (LE 309520).

Stigmidium tabacinae (Arnold) Triebel

LITERATURE REPORTS. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya, Republic of Daghestan; on *Toninia cinereovirens*, *T.* cf. *sedifolia* and *T. taurica* (Urbanavichus & Ismailov 2013, Urbanavichus & Urbanavichene 2015a, Zhurbenko & Otte 2012).

Stigmidium vezdae Matzer

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Fellhanera colchica* (Matzer 1996).

Stigmidium xanthoparmeliarum Hafellner

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Xanthoparmelia stenophylla* (Zhurbenko & Kobzeva 2014).

Taeniolella beschiana Diederich

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Cladonia arbuscula*, *C. coniocraea*, *C.* cf. *phyllophora* and *Cladonia* sp. (Zhurbenko & Kobzeva 2014, Zhurbenko & Pino-Bodas 2017).

Taeniolella delicata M.S. Christ. & D. Hawksw.

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Lecanora intumescens* (Zhurbenko & Kobzeva 2014).

Taeniolella phaeophysciae D. Hawksw.

LITERATURE REPORT. – **RUSSIA:** Caucasus, locality and host not specified (Urbanavichus 2010).

Taeniolella punctata M.S. Christ. & D. Hawksw.

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, on *Graphis scripta* (Otte 2004, Zhurbenko & Otte 2012).

***Talpapellis peltigerae* Alstrup & M.S. Cole**

NOTE. – This species was formerly known in Russia only from Siberia and Chukotka (Heuchert et al. 2014, Zhurbenko et al. 2016), and is here newly documented for the Caucasus.

Specimen examined. – **3:** on *Peltigera leucophlebia* (moribund parts of lobes), 9.viii.2014, *M.P. Zhurbenko 14358a* (LE 309466a).

Talpapellis solorinae Zhurb., Heuchert & U. Braun

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Solorina crocea* (Zhurbenko et al. 2015c).

L*Tetramelas phaeophysciae* A. Nordin & Tibell

NOTES. – According to Nordin and Tibell (2005) this is an obligately lichenicolous endoparasitic lichen. It was formerly known in Russia from the Murmansk Region**,** Yamal-Nenets Autonomous Area, Krasnoyarsk Territory, Republic of Buryatia and Trans-Baikal Territory (Urbanavichene & Urbanavichus 2009, Zhurbenko 2009b, Zhurbenko et al. 2016), and is here newly documented for the Caucasus.

Specimen examined. – **18:** on *Physcia* cf. *stellaris* (thallus), 28.viii.2014, *M.P. Zhurbenko 14233* (LE 309417).

Thamnogalla crombiei (Mudd) D. Hawksw.

NOTE. – This species is here newly reported for the Krasnodar Territory of Russia.

Specimen examined. – **14:** on *Thamnolia vermicularis* var. *subuliformis* (thallus), 21.viii.2014, *M.P. Zhurbenko 14487* (LE 309549).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Thamnolia vermicularis* var. *subuliformis* (Zhurbenko & Kobzeva 2014, 2016).

L*Thelocarpon* cf. *sphaerosporum* H. Magn.

NOTES. –The specimen examined has ascomata that are more or less doliiform, truncate above, with a narrowly exposed hymenial disc, 100–200 µm in diameter, and ascospores that are subglobose, ovoid, broadly oblong or broadly ellipsoid, and measure (4.6–)5.2–7.0(–7.9) × (4.3–)4.6–5.4(–5.7) µm, l/b = (1.0–)1.1–1.3(–1.6) (n=43). The examined material is morphologically closest to *Thelocarpon sphaerosporum*, characterized by spherical ascospores, 4.5–6 µm in diameter, but also resembles *T. impresselum* Nyl., which is characterized by oblong ascospores, 6–8.5(–11) × 4–5 µm in diameter (Orange et al. 2009). Both species are possibly scarcely lichenized and sometimes grow on lichens (Hafellner & Türk 2001, Orange et al. 2009, Santesson et al. 2004, Zhurbenko & Brackel 2013). So far *Thelocarpon sphaerosporum* has not been reported from Asia or Russia.

Specimen examined. – **14:** on *Catapyrenium cinereum* (margins of squamules) and adjacent cyanobacterial film over organic soil, 21.viii.2014, *M.P. Zhurbenko 14407* (LE 309553).

Toninia episema (Nyl.) Timdal

LITERATURE REPORTS. – **RUSSIA:** Republic of Daghestan, on *Circinaria calcarea* (Urbanavichus & Ismailov 2013, Urbanavichus et al. 2011).

Toninia leptogii Timdal

LITERATURE REPORTS. – **REPUBLIC OF ABKHAZIA:** on *Leptogium plicatile* (Urbanavichus & Urbanavichene 2012). **RUSSIA:** Republic of Daghestan, on *L. plicatile* (Urbanavichus & Ismailov 2013, Urbanavichus et al. 2011).

Toninia plumbina (Anzi) Hafellner & Timdal

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Pectenia plumbea* (Bredkina et al. 2003).

Tremella candelariellae Diederich & Etayo

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Candelariella xanthostigma* (Urbanavichus & Ismailov 2016).

Tremella cetrariicola Diederich & Coppins

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Tuckermannopsis chlorophylla* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014).

Tremella hypogymniae Diederich & M.S. Christ.

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Hypogymnia incurvoides* and *H. physodes* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

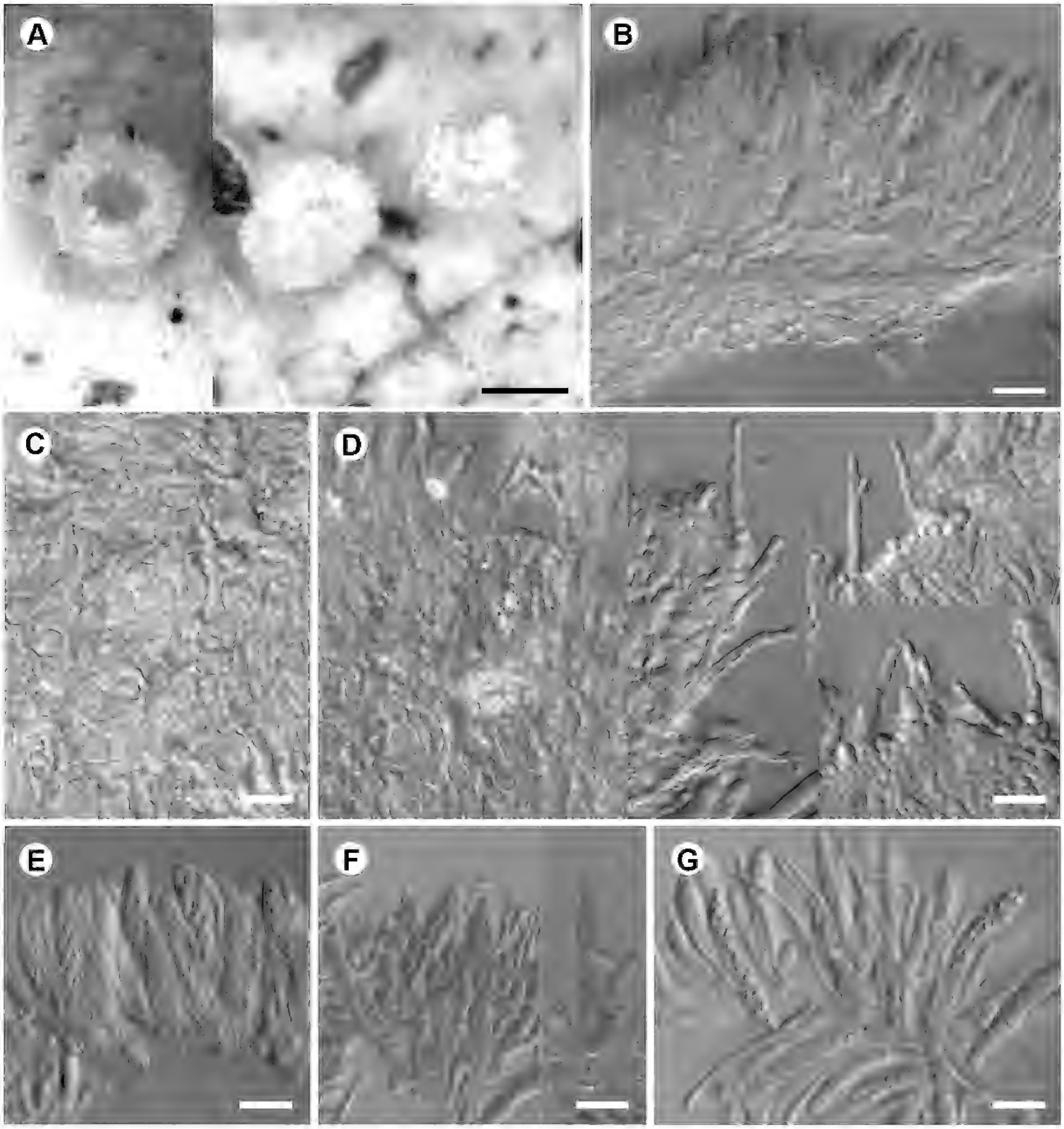

Figure 3, a presumably undescribed fungus with hairy apothecia growing on *Thamnolia vermicularis* (all from LE 309620). A, ascomata. B, ascoma in cross section in water. C, exciple in surface view in water. D, excipular hairs in water. E, asci with spores in water. F, asci with spores in phloxine after K; note asci arising from croziers. G, asci with spores and paraphyses in K/I; note tholus with K/I+ blue central tube. Scale bars: A = 100 µm, B–G = 10 µm.

Trichonectria anisospora (Lowen) van den Boom & Diederich

NOTE. – This species was formerly known in Russia from the Caucasus (see literature report below) and Republic of Karelia (Alstrup et al. 2005), and is here newly reported for the Krasnodar Territory.

Specimen examined. – **18:** on *Hypogymnia physodes* (moribund thallus), 29.viii.2014, *M.P. Zhurbenko 14239* (LE 309572).

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Hypogymnia physodes* (Zhurbenko & Kobzeva 2014).

Unguiculariopsis lettaui (Grummann) Coppins

NOTE. – So far this species has been known in Russia only from the Caucasus and Trans-Baikal Territory (Zhurbenko et al. 2016).

Specimen examined. – **8:** on *Evernia prunastri* (thallus), 14.viii.2014, *M.P. Zhurbenko 14329a* (LE 309418a).

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, Republic of Adygeya; on *Evernia prunastri* (Zhurbenko & Otte 2012).

Unguiculariopsis thallophila (P. Karst.) W.Y. Zhuang

NOTE. – This species was formerly known in Russia from the Caucasus (see literature report below) and Chukotka Autonomous Area (Zhurbenko 2009b), and is here newly reported for the Krasnodar Territory.

Specimen examined. – **12:** on *Lecanora carpinea* (thallus), 23.viii.2014, *M.P. Zhurbenko 14450* (LE 309513).

LITERATURE REPORT. – **RUSSIA:** Republic of Daghestan, on *Lecanora chlarotera* (Urbanavichus & Ismailov 2013).

Vouauxiella lichenicola (Linds.) Petr. & Syd.

NOTE. – This species was formerly known in Russia from the Caucasus (see literature reports below) and Kaliningrad Region (Dedkov et al. 2007), and is here newly reported for the Krasnodar Territory.

Specimens examined. – **4:** on *Lecanora pulicaris* (apothecia, thallus), 10.viii.2014, *M.P. Zhurbenko 14457* (LE 309516); 10.viii.2014, *M.P. Zhurbenko 14470a* (LE 309518a); **20:** on *L. intumescens* (apothecia, thallus), 10.ix.2014, *M.P. Zhurbenko 14475* (LE 309517).

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya, on *Lecanora intumescens* and epiphytic *Lecanora* sp. (Zhurbenko & Kobzeva 2014, Zhurbenko & Otte 2012).

Xanthoriicola physciae (Kalchbr.) D. Hawksw.

LITERATURE REPORT. – **RUSSIA:** Stavropol Territory, on *Xanthoria parietina* (Zhurbenko & Kobzeva 2014).

Xenonectriella leptaleae (J. Steiner) Rossman & Lowen

NOTES. – Exciple K+ purple, ascospores (9.0–)10.2–11.6(–12.0) × (6.8–)7.1–7.9(–8.0) µm (n=14), l/b = 1.3–1.5(–1.6) (n=14). According to Rossman et al. (1999), the exciple of the species reacts K+ pale brown to black. However, the examined material fits well the description in Brackel (2014), including the exciple reaction with K and the size of the ascospores. *Heterodermia speciosa* is a new host species.

Specimen examined. – **17:** on *Heterodermia speciosa* (thallus), 1.ix.2014, *M.P. Zhurbenko 14451* (LE 309546).

LITERATURE REPORTS (as *Xenonectriella* cf. *leptaleae*). – **RUSSIA:** Karachayevo-Circassian Republic, Krasnodar Territory, Republic of Adygeya; on *Physcia aipolia*, *P. stellaris* and *Physconia distorta* (Zhurbenko & Kobzeva 2014, 2016; Zhurbenko & Otte 2012).

Xenonectriella ornamentata (D. Hawksw.) Rossman

LITERATURE REPORT. – **RUSSIA:** Karachayevo-Circassian Republic, on *Peltigera lepidophora* (Zhurbenko & Kobzeva 2014).

Zwackhiomyces berengerianus (Arnold) Grube & Triebel

Specimen examined. – **12:** on *Mycobilimbia tetramera* (thallus), 19.viii.2014, *M. P. Zhurbenko 14416* (LE 309483).

LITERATURE REPORT. – **RUSSIA:** Krasnodar Territory, on *Bacidia rubella* (Zhurbenko & Kobzeva 2016).

Zwackhiomyces coepulonus (Norman) Grube & R. Sant.

NOTES. – The ascospores of the specimen examined are somewhat longer than reported by Grube and Hafellner (1990) ((15.3–)18.0–22.0(–23.3) × (6.2–)7.1–8.5(–9.0) µm, l/b = (2.0–)2.3–2.9(–3.3) (n=16) in the specimen examined vs. (15–)16–20(–21) × 5.5–8.5(–9) µm, l/b = 2.6). The species was formerly known

in Russia from the Caucasus (see literature reports below), Nenets Autonomous Area and Krasnoyarsk Territory (Zhurbenko 2009b), and is here newly reported for the Krasnodar Territory.

Specimen examined. – **14:** on *Rusavskia elegans* (thallus), 21.viii.2014, *P.M. Zhurbenko s.n.* (LE 309548).

LITERATURE REPORTS. – **RUSSIA:** Republic of Adygeya, on *Rusavskia elegans* and *Variospora australis* (Urbanavichus & Urbanavichene 2014, Zhurbenko & Kobzeva 2016).

Zwackhiomyces echinulatus Brackel

LITERATURE REPORTS. – **RUSSIA:** Karachayevo-Circassian Republic, Republic of Adygeya; on *Physconia distorta* (Zhurbenko & Kobzeva 2014, 2016).

Zwackhiomyces kiszkianus D. Hawksw. & Miądl.

NOTES. – In the specimen examined the ascospores are hyaline, smooth-walled and measure (16.0–)17.7–21.5(–23.3) × (7.0–)7.3–8.7(–9.0) µm, l/b = (2.1–)2.3–2.7(–2.8) (n=18), while in the protologue they were reported as granular and somewhat larger (19.5–25.5 × 8.5–13 µm; Hawksworth & Miądlikowska 1997). However, according to Zhurbenko (2013a) and Brackel (2014), ascospores of this species vary significantly in size and occasionally are smooth-walled. The species was formerly known in Russia from an uncertain report in the Murmansk Region (Urbanavichus 2016) and is here newly documented for Asian Russia.

Specimen examined. – **7:** on *Peltigera praetextata* (lobes, partly damaged), 13.viii.2014, *M.P. Zhurbenko 14357* (LE 309467).

Zwackhiomyces physciicola Alstrup

LITERATURE REPORT. – **RUSSIA:** Republic of Adygeya, on *Phaeophyscia orbicularis* (Urbanavichus & Urbanavichene 2014).

Unidentified ascomycete with hairy apothecia

FIGURE 3

DESCRIPTION. – *Ascomata* apothecia, sessile, cup-shaped, constricted at the base, 70–170 µm in diameter, 50–100 µm tall, disc at first mostly covered by the exciple, later widely exposed, disc and margins pale orange yellow/buff when dry, translucent, margins densely covered by white hairs. *Exciple* in surface view resembling *textura angularis* or *textura prismatica*, composed of cells ca. 3–6 × 2–4 µm to ca. 8–15 × 3–5 µm. *Excipular hairs* hyaline, narrowly obclavate, 21–36 µm long, filiform, flexuose, knobby and 1–2.5 µm wide above, narrowly ellipsoid and 3.5–5 µm wide below, not branched, aseptate, not interspersed with crystals or granules, without glassy or refractive portions. *Periphyses* absent. *Epihymenium* indistinct. *Hymenium* hyaline, 30–40 µm tall, I and K/I–. *Paraphyses* hyaline, filiform, apically not enlarged, sometimes slightly flexuous, 25–35(–40) µm long, 1.3–2.0 µm in diameter, not interspersed with crystals or granules, sometimes with 1–2 septa, occasionally branched. *Asci* ellipsoid, broadly cylindrical, clavate or narrowly oblanceolate, usually not distinctly stalked, arising from croziers, with a broad, often enlarged, more or less truncate foot, tapering to sometimes slightly applanate apex, with a tholus 1–2.5 µm thick, penetrated by a hardly visible in water central tube that is slightly widening upwards and I and K/I+ blue, otherwise I and K/I–, (23.8–)25.9–31.5(–32.5) × (3.8–)4.4–5.6(–6.1) µm (n=39, in water or K), 8-spored. *Ascospores* hyaline, narrowly ellipsoid to fusiform, (5.6–)6.2–7.6(–8.9) × (1.7–)1.9–2.3(–2.5) µm, l/b = (2.5–)2.8–3.8(–4.5) (n=30, in water or K then phloxine), aseptate, smooth-walled, non-halonate, often with a conspicuous guttule at each end, biseriate or diagonally uniseriate in the ascus.

NOTES. – Respecting the other known lichenicolous species with hairy ascomata, the examined material is comparable to *Echinodiscus kozhevnikovii* Zhurb., *Hyalopeziza rapax* Huhtinen, *Polydesmia lichenis* Huhtinen & R. Sant., *Protounguicularia fasciculata* (Etayo) Etayo, *P. nephromatis* (Zhurb. & Zavarzin) Huhtinen, D. Hawksw. & Ihlen, and species of *Rhymbocarpus*, *Skyttea* and *Unguiculariopsis* (Diederich & Etayo 2000, Etayo & Triebel 2010, Huhtinen & Santesson 1997, Huhtinen et al. 2008, Zhurbenko 2009b). However, all of those taxa have significant differences from the present taxon. *Echinodiscus kozhevnikovii* readily differs in having clavate, stalked, I– asci without a distinct tholus and apical apparatus. *Hyalopeziza rapax* has apically glassy excipular hairs. *Polydesmia lichenis* differs in the undulating paraphyses with sometimes coiled to branched apices and the 0–3-septate ascospores.

Protounguicularia fasciculata has septate excipular hairs, pale yellow hymenium and apically slightly enlarged, K/I– asci. *Protounguicularia nephromatis* can be distinguished by the apically glassy, septate excipular hairs and the K/I– asci without a distinct tholus. Species of *Rhymbocarpus*, *Skyttea* and *Unguiculariopsis* are characterized by dark-colored ascomata (at least in their exposed parts), pigmented exciples and I and K/I– asci. The examined material evidently represents an undescribed lichenicolous fungus of an unclear generic affiliation, but is too scant to serve as a type. Nonetheless it should be considered as an addition to the key of fungi that grow on *Thamnolia* (Zhurbenko 2012a).

Specimen examined. – **14:** on *Thamnolia vermicularis* var. *subuliformis* (moribund bases of podetia), 21.viii.2014, *M.P. Zhurbenko 14149* (LE 309620).

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Acarospora smaragdula var. *lesdainii* forma *fulvoviridula* is a synonym of *Myriospora scabrida*

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ABSTRACT. – *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula* is lectotypified and synonymized with *Myriospora scabrida*. The use of the epithet at the species level as *A. flavoviridula* is shown to be illegitimate, as is the combination into *Myriospora*.

KEYWORDS. – Acarosporaceae, Czech Republic, France, Germany, lectotype, nomenclature, taxonomy.

INTRODUCTION

We are currently working on the revision of Acarosporaceae in central Europe to produce better illustrated keys for the region. This contribution continues a series of studies revising difficult, little known or forgotten European species in preparation for the aforementioned keys (Knudsen et al. 2014, 2015, in press; Knudsen & Kocourková 2016 & 2017; Knudsen & Nordin 2015). Here we resolve the taxonomy and typification of *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula* Harm. *ex* H. Magn. (Magnusson 1929).

MATERIALS AND METHODS

Hand sections of specimens from PRM, UPS and the personal herbarium of Hans Ulrich (hb. Ulrich) were studied using standard microscopy (following Brodo et al. 2001). Measurements were made in water. Spot tests were carried out with KOH and C and amyloid hymenium reactions were tested with fresh undiluted Lugol's (I). A small sample of rock from the lectotype of *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula* was tested with hydrochloric acid (HCl). Macromorphological photographs were taken with a digital camera Olympus DP72 mounted on an Olympus SZX 7 Stereomicroscope with image stacks processed using the software Olympus Deep Focus 3.1.

TAXONOMIC SECTION

Myriospora scabrida (Hedl. *ex* H. Magn.) K. Knudsen & L. Arcadia, Opuscula Philolichenum 11: 23. 2011. ≡ *Acarospora scabrida* Hedl. *ex* H. Magn. Götebergs Kgl. Vet. och Vitterh. Samh. Handl. 28: 55 1924. ≡ *Silobia scabrida* (Hedl. *ex* H. Magn.) M. Westb., Lichenologist 43(1): 20. 2011. ≡ *Trimmatothelopsis scabrida* (Hedl. *ex* H. Magn.) Cl. Roux & Nav.-Ros., Bull. Soc. linn. Provence 62: 176. 2011. **TYPE: NORWAY: SØR-TRØNDELAG:** Røros, På jord å vägkant, 15.vii.1895, on soil, *E. Vrang & J.P. Gustafsson* s.n. (UPS!, lectotype selected by Knudsen (2008)).

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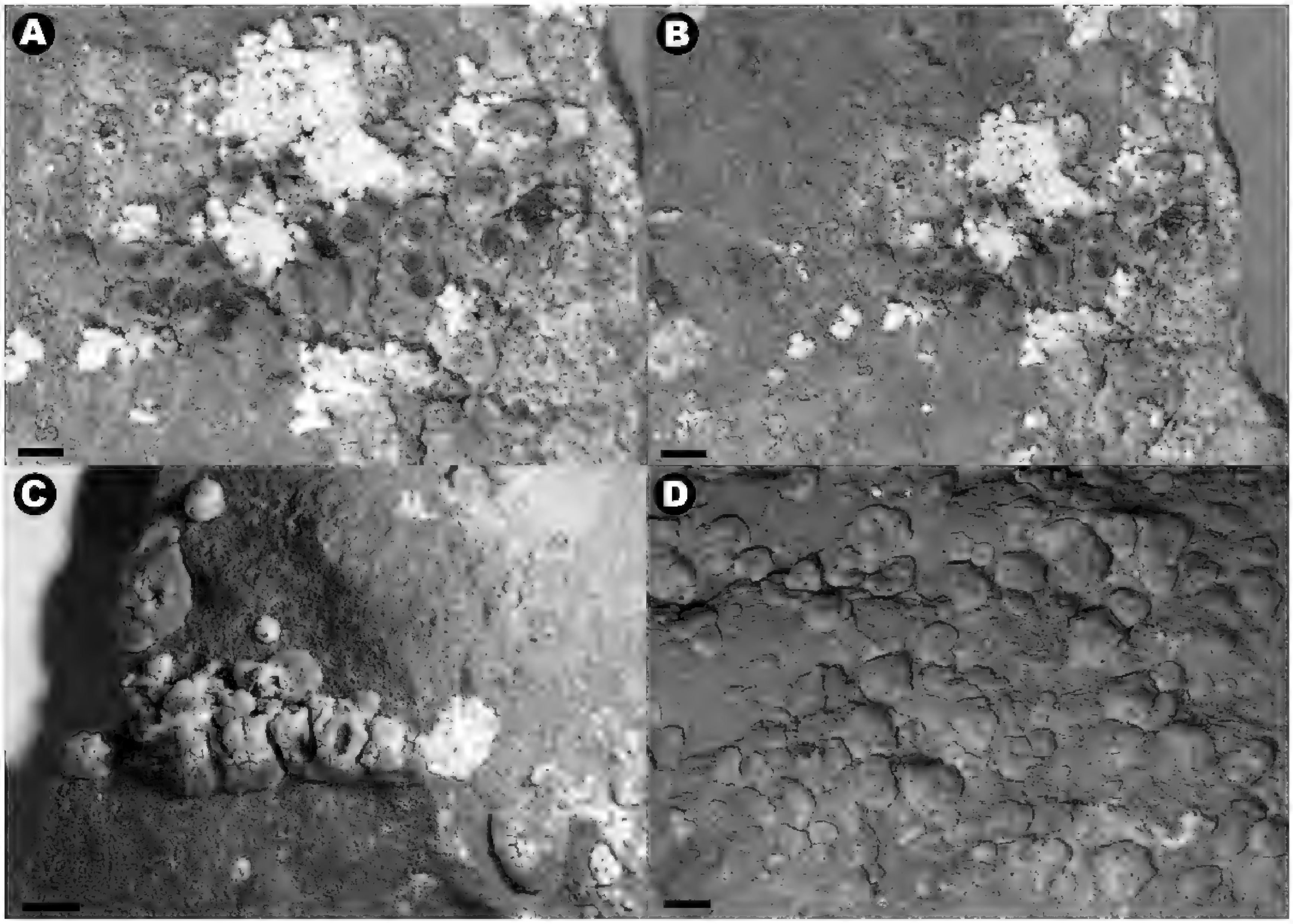

Figure 1. Type material of *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula*. A–C, lectotype (*Crozals s.n.*, UPS) identified as *Myriospora scabrida* illustrating thallus on HCl- rock with calcium carbonate deposit probably from adjacent eroding calcareous rocks (A and B), and thallus with typical mature elevated apothecia (C). D, syntype (*Kuták 1800*, UPS) identified as *M. tangerina*. Scales 0.5 mm in A, 1.0 mm in B–D.

= *Acarospora verruciformis* H. Magn. Göteborgs Kgl. Vet. och Vitterh. Samh. Handl. 28: 58. 1924. **TYPE: NORWAY. SØR-TRØNDELAG:** Rörås, 600 m, 24.vii.1919, on siliceous rock, *A.H. Magnusson 3688* (UPS[n.v.], lectotype (selected by Jørgensen & Nordin (2009)), S[n.v.], isolectotype)

= *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula* Harm. *ex* H. Magn., Kongl. Svenska Vetensk.-Acad. Handl., ser. 3, 7(4): 145. 1929. **TYPE: FRANCE. LANGUEDO-ROUSILLON:** Hèrault, Lamalou-des-Bains, iv.1906, on non-calcareous rock, *A. de Crozals s.n.* (UPS!, lectotype **designated here**).

Based on the available data *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula* was first validly published by H. Magnusson in his monumental monograph on *Acarospora* (Magnusson 1929) wherein he associated a description with a what was then presumably an unpublished manuscript name of Harmand. The description in Magnusson (1929) was simple: "This is a mean form certainly due to the station: moist or shady situation. Squamules very thick and convex, often irregular in shape. Apothecia sometimes pale. There are often transitional stages". For Magnusson, this taxon was basically a color form caused by shade and water as alluded to in the epithet "*fulvoviridula*". He did not designate a type specimen and instead listed three gatherings in the protologue: a collection from France, a collection from Romania, and a collection from Krkonoše in the Czech Republic. We examined two of the three collections cited by Magnusson, specifically the collections from France and the Czech Republic.

The French specimen (Fig. 1A–C; Fig.2) was collected by André de Crozals and likely originally belonged to the French botanist Julien H.A.J. Harmand (1844–1915), who gave it to Maurice Bouly de Lesdain. If a duplicate of the specimen existed in the herbarium of Bouly de Lesdain it would have been lost in the bombing of Dunkerque during World War II as was the case for the rest of Bouly de Lesdain's herbarium (Abbayes 1966, DePriest 1996, Knudsen et al. in press). The collection from France is typical

Myriospora scabrida with pale yellowish-brown coloration, mature elevated apothecia, a thick cortex (30–50 µm), a high (170–180 µm), amyloid hymenium, interrupted algal layer, paraphyses that are 1.0–1.5 µm wide at midlevel, ascospores that are mostly narrowly ellipsoid (4–5 × 1.5 µm), a typical subhymenium with scattered round cells, and no secondary metabolites (for descriptions of *M. scabrida* see Magnusson 1929, Knudsen 2008, and Westberg et al. 2011). Pruina is also present on some of the areoles, a character which infrequently occurs on some specimens of *M. scabrida* (Westberg et al. 2011, Purvis et al. in press). The lectotype occurs on non-calcareous rock (HCl-). Probably eroding adjacent calcareous rock deposited piles of calcium carbonate crystals on the naked rock as well as the areoles of the specimen (Fig. 1).

The specimen from the Czech Republic, collected by Václav von Kuták (Fig. 1D), comprises areoles of *Myriospora tangerina* (M. Westb. & Wedin) K. Knudsen & L. Arcadia, growing on iron-rich rock collected in the Krkonoše Mountains, at Kiesberg, along the shady Rudný brook. *Myriospora tangerina* is common in the Krkonoše Mountains (Westberg et al. 2011; Knudsen et al. in press). The specimen is typical, with rounded orange areoles (faded from age), small punctiform apothecia, a thick cortex (40–70 µm), a high hymenium (160–200 µm), interrupted algal layer, paraphyses that are 1.0–1.5 µm wide at midlevel, ascospores that are mostly thin ellipsoid (4–5 × 1.5 µm), and no secondary metabolites (for a description of *M. tangerina* see Westberg et al. 2011). We designate the collection from France by André de Crozals the lectotype for *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula* because we think Magnusson would have designated it as holotype based on Magnusson's attribution of the name to Harmand. We synonymize the form with *Myriospora scabrida*.

Clauzade and Roux (1981: 74) cited *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula* (Harm.) H. Magn. when they published the name "*Acarospora fulvoviridula* Harm.". Citation of the former name clearly linked it to the latter and strongly suggests that they intended to treat Magnusson's infraspecific taxon at the species level using Harmand's original unpublished manuscript name. Although Clauzade and Roux (1981) likely did not intend to introduce a nomenclatural novelity in their treatment, their publication must be treated as an attempt at a combination and status novum. This change was however, invalid under Art. 41.5 of the *ICN* because after 1953 a full and direct citation of the basionym was required (McNeill et al. 2012). Later, Roux et al. (2014) attempted to combine the epithet into the genus *Myriospora*, but in doing so only cited "*Acarospora fulvoviridula* Harm. in sched." rather than the basionym published by Magnusson (1929) or the invalid treatment at the species level by Clauzade and Roux (1981). The new combination *Myriospora* is also invalid under Art. 41.5 of the *ICN* (McNeill et al. 2012). Clauzade and Roux (1985), without citing specimens, stated that *A. fulvoviridula* occurs in the Czech Republic, France, Germany, and Romania. However, those authors were probably referring to specimens identified by H. Magnusson as *A. smaragdula* var. *lesdainii* forma *fulvoviridula* (Magnusson 1929) and a suite of specimens collected by Hans Ulrich in Germany that were annotated by Roux in 1982 (cited in Wirth et al. 2013).

Although *Acarospora fulvoviridula* was invalidly published by Clauzade and Roux (1981), their application of the name is relevant from the standpoint of *Acarospora* in Europe as their description reported at least three characters that do not match the lectotype selected here. A short description of *A. fulvoviridula* reported a hymenium height of 100–140 µm (Clauzade & Roux 1981). The lectotype from France has a hymenium height of 170–180 µm. The description also cited paraphyses as being up to 2 µm wide but all paraphyses measured were 1.0–1.5 µm in width in the lectotype. The taxon was also identified in their keys by its pruina, where it was placed in couplet with *A. versicolor* Bagl. & Car. (Clauzade & Roux 1981) and this was recently mentioned as a distinguishing character for the taxon (Roux et al. 2014). Pruina on the lectotype of *A. smaragdula* var. *lesdainii* forma *fulvoviridula* is variably present or absent on areoles and probably environmental in origin (see discussion in the preceding paragraph). The Ulrich collections from Germany annotated by C. Roux as *A. fulvoviridula* in 1982 (*Ulrich 5182 & 5183*) also have a hymenium height of 170–180 µm with thin paraphyses and do not match description in Clauzade and Roux (1981). They have pruina on some areoles but not on most of the areoles. We identified the Ulrich collections as *M. scabrida*. The specimen from the Czech Republic that we identified as *M. tangerina* has no pruina as well as a high hymenium and narrow paraphyses (see above). We did not see the specimen from Romania. We do not accept the species concept of *Acarospora fulvoviridula* proposed by Clauzade and Roux (1981, 1985; see also Roux et al. 2014) as objectively referring to any known taxon in Europe.

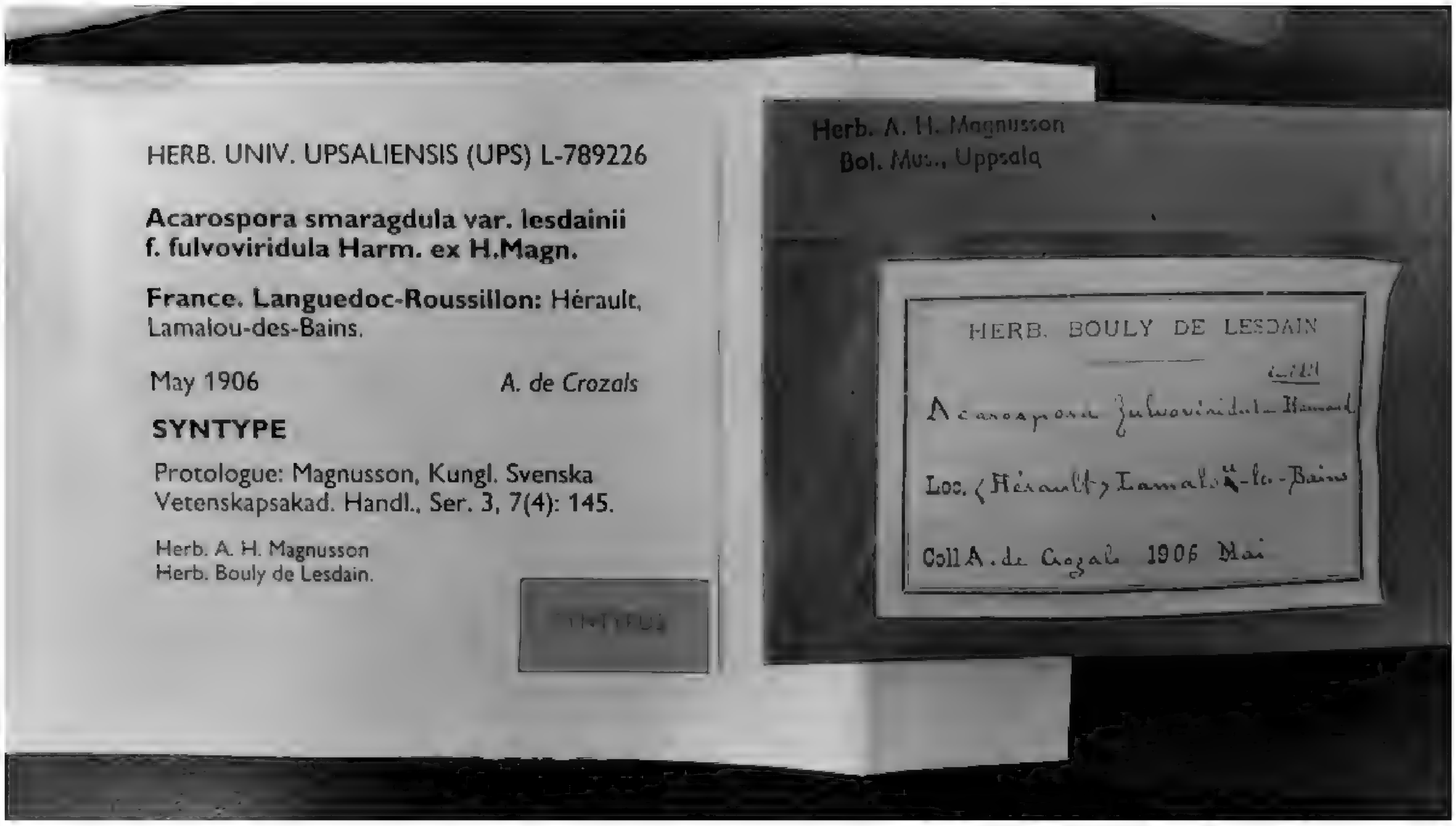

Figure 2. Labels for lectotype of *Acarospora smaragdula* var. *lesdainii* forma *fulvoviridula* (*Crozals s.n.*, UPS).

Other specimens examined. – CZECH REPUBLIC. North Bohemia: Krkonoše Mountains: Kiesberg, Rudný brook, on non-calcareous rock with iron, 1919, *V. Kuták no. 1800* (UPS & PRM, annotated by K. Knudsen as *M. tangerina*, 2017). GERMANY. lNierdersachsen, Landkreis Goslar, auf zinkoxydhaltiger Räumasche und Ziegelbrocken entlang des Bahndammes nördlich von Hüttenwerk Oker, ± 250 m, 1981, *H. Ullrich 5182* (herb. Hans Ullrich; annotated by C. Roux as "*Acarospora fulvoviridula* Harm. in sched.", 1982; annotated K. Knudsen as *M. scabrida*, 2017), an erzhaltigen Silikatfelsen von Steilstufen, vorwiegend in Rissen im Kommunion-Steinbruch am NW-Hang des Rammelsberges, ± 500 m, xi. 1982, *H. Ulrich 5183* (herb. Hans Ullrich; annotated by C. Roux as "*Acarospora fulvoviridula* Harm. in sched." 1982; annotated K. Knudsen as *M. scabrida,* 2017).

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Acarospora toensbergii (Acarosporaceae), a new species from Alaska, U.S.A.

KERRY KNUDSEN[1] AND JANA KOCOURKOVÁ[2]

ABSTRACT. – *Acarospora toensbergii* is described from Alaska in North America. The new species grows on siliceous rock and is easily recognized by its dispersed, solitary apothecia with a thick brown thalline margin, its amyloid hymenium and subhymenium, its lack of secondary metabolites, and its large mature ascospores that often measure up to 7 × 3 µm. Reports of *Acarospora gallica* and *A. variegata* from North America (New Mexico) are misidentifications of *Acarospora janae*. *Acarospora canadensis* is removed from synonymy with *Acarospora glaucocarpa.*

KEYWORDS. – Lecanorine apothecia, rare species, taxonomy.

INTRODUCTION

Lecanorine apothecia are ascocarps with a thalline margin and are common in lichenized fungi (Brodo et al. 2001; Wirth et al. 2013). True lecanorine apothecia are rare in the genus *Acarospora* (Knudsen 2007). Only a small number of species in Europe and North America produce lecanorine apothecia directly from an endolithic hypothallus. Examples include *A. janae* K. Knudsen from North America (Knudsen et al. 2011) and *A. rehmii* H. Magn. from central Europe (Malíček 2017). Usually in *Acarospora* there are one to twelve immersed apothecia without a thalline margin in the centers of areoles or squamules, although many species of the genus have what we consider pseudo-lecanorine apothecia. In pseudo-lecanorine apothecia, solitary immersed apothecia expand and reduce an areole or squamule to a thalline margin. Typical of this ontogeny is *A. cervina* A. Massal. (see Wirth et al. 2013 for a photograph of *A. cervina* with the apothecia in the process of expanding to fill the squamules and form lecanorine apothecia). *Acarospra cervina* regularly produces pseudo-lecanorine apothecia, but many species, such as *A. fuscata* (Schrad.) Arnold, only occasionally produce pseudo-lecanorine apothecia (Magnusson 1929).

During a trip to Kenai Fjords National Park in Alaska, the Norwegian lichenologist Tor Tønsberg collected a new taxon with lecanorine apothecia that had thick thalline margins emerging from an endolithic hypothallus. Here we describe this taxon as *Acarospora toensbergii* in honor of Tor Tønsberg's contribution to European and North American lichenology.

MATERIALS AND METHODS

Hand-cut sections of specimens from BG, CANL, NY, and UCR were studied using standard microscopy (following Brodo et al. 2001). Measurements were made in water. Structures were studied with KOH. Amyloid reactions of thin squashed sections were tested with fresh, undiluted Merck Lugol's (IKI). Macromorphological photographs were taken with a digital camera Olympus DP72 mounted on an Olympus SZX 7 stereomicroscope with image stacks processed using the software Olympus Deep Focus 3.1.

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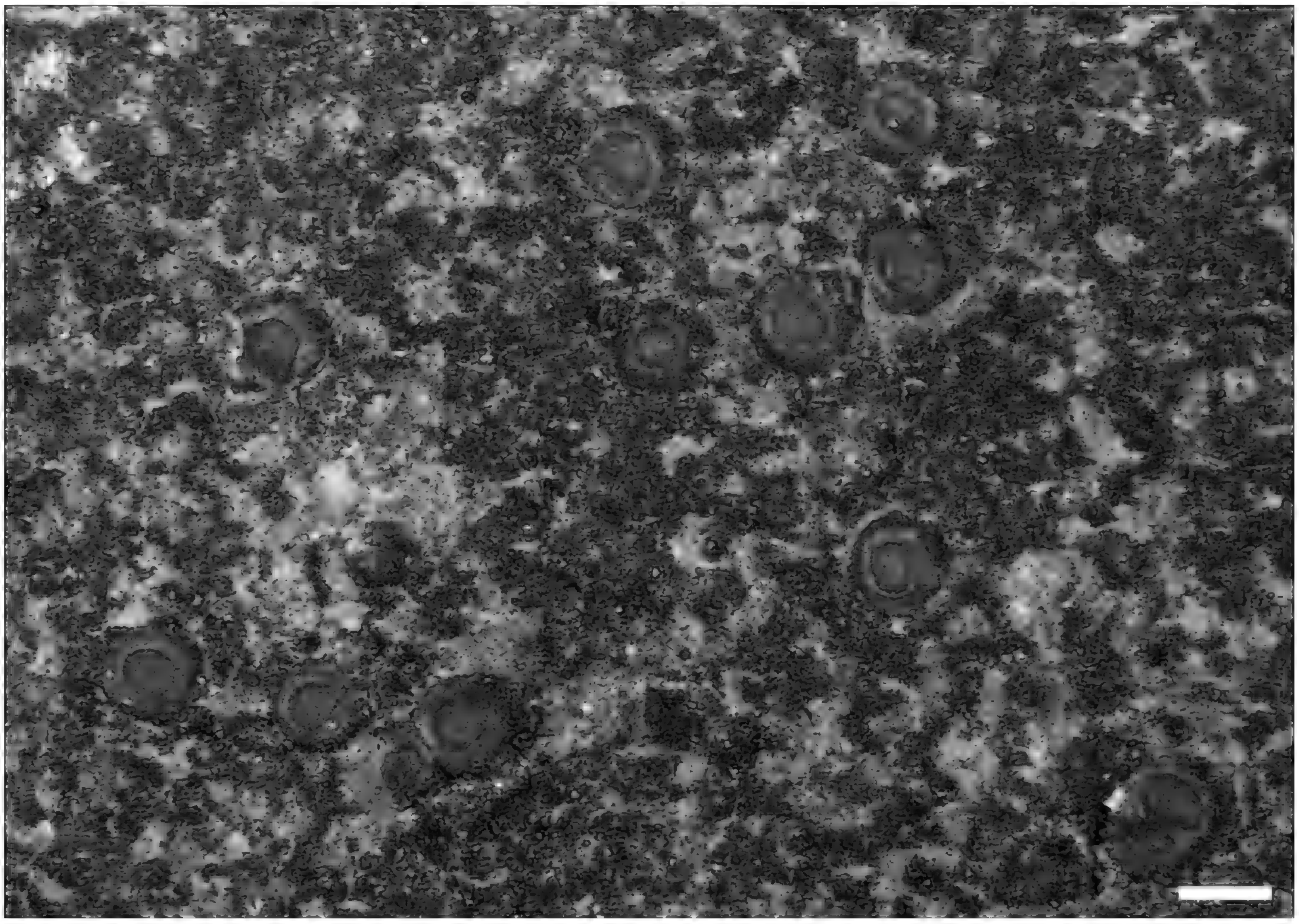

Figure 1. Morphology of *Acarospora toensbergii* (holotype, *Tønsberg 45624*). Scale = 0.5 mm.

TAXONOMIC SECTION

Acarospora toensbergii **K. Knudsen & Kocourk., sp. nov.**

FIGURES 1 & 2.

MYCOBANK #MB823029.

Similar to *Acarospora janae* but differing especially in having a parathecium expanded around the apothecial disc and in not producing gyrophoric acid.

TYPE: **U.S.A. ALASKA.** KENAI PENINSULA CO.: Kenai Fjords National Park, Exit Glacier Park Campground, 60°11′10″N, 149°40′27″W, 795 m, 12.vii.2015, on siliceous rock marking path between campsites, *T. Tønsberg 45624* (BG!, holotype; ALA!, PRM!, isotypes).

DESCRIPTION. – Hypothallus endolithic, IKI-, algae not observed in substrate. Epilithic thallus lacking. Apothecia round, dispersed, or rarely replicating by division, 0.4–1.0 mm wide and 300–400 µm high, emerging from the endolithic hypothallus. Thalline margin brown, up to 200 µm wide. Upper cortex (20–)30–40 µm thick, cortical cells mostly round and 5–6 µm in diameter, upper layer brown ca. 10 µm thick, lower layer hyaline. Lateral cortex 30–60 µm thick, extending to base of apothecia, cortical cells mostly round and 5–6 µm, the outer layer brown or often blackened in holotype. Algal layer continuous beneath hypothecium and filling the margins, ca. 50–100 µm thick, not interrupted by hyphal bundles, algal cells 8–12 µm in diameter. Medulla up to 200 µm thick, of thin-walled hyphae 2–3 µm wide, mostly obscure and mixed with substrate crystals, IKI-, continuous with endolithic hypothallus.

Disc round, reddish-brown, smooth, epruinose, lower than the top of margin. Parathecium expanded around disc usually to about 40 µm, not visible from above as parathecial crown, IKI-, hyphae mostly 2 µm in diameter, ending at surface with apices expanded to 6 µm and brown, intergrading with cortex. Parathecium sometimes expanding to 100 µm wide and excluding most or all of the upper cortex but not excluding the lateral cortex. Epihymenium 10 µm high, reddish-brown, coherent in thick gel, IKI-.

Hymenium (90–)100–120 µm tall, paraphyses mostly 2 µm wide at midlevel with oil drops, cells at mid-level 5–7 µm long, about 10 µm below apices the cells becoming 2–3 µm long, apices to 4 µm wide in gel cap, hymeninal gel IKI+ blue below epihymenium. Asci cylindrical, fully developed ca. 50 × 10 µm, 100 or less ascospores, often asci poorly developed. Ascospores 7 × 3 µm when fully developed, but often 5–6 × 2.0–2.5 µm. Subhymenium about 40 µm thick, IKI+ blue. Hypothecium 10 µm thick, IKI-. No pycnidia observed. No secondary metabolites with TLC (Tønsberg, pers. comm.)

ETYMOLOGY. – The species is named in honor of the Norwegian lichenologist Tor Tønsberg (b. 1948), collector of the type specimen, in honor of his important and continuing contributions to the study of lichenized fungi in Europe and North America.

ECOLOGY AND DISTRIBUTION. – Known only from Kenai Fjords National Park in Alaska, on siliceous rock. It is likely a pioneer species of hard exposed rock and a poor competitor with other saxicolous lichens. The type collection of *A. toensbergii* was made on a recently deglaciated alluvial terrace.

DISCUSSION. – The North American species with consistently lecanorine apothecia arising from an endolithic hypothallus that is most similar to *Acarospora toensbergii* is *A. janae* (Brodo 2016). *Acarospora janae* differs from *A. toensbergii* especially having an indistinct parathecium, smaller mature ascospores (3–4 × 2 µm vs. 7× 3 µm) and in producing gyrophoric acid (Knudsen et al. 2011). Though the data were not included in the protologue (Lumbsch et al. 2011), *A. janae* like *A. toensbergii* has blue amyloid hymenial gel. Some confusion surrounds *A. janae*. Magnusson (1930) reported two European species with pseudo-lecanorine apothecia new to North America, *A. gallica* H. Magn. and *A. variegata* H. Magn. These reports were however, based on taxon later described as *A. janae* from New Mexico. Magnusson identified specimens of *A. janae* with a lighter brown thalline margin as *A. gallica.* Whereas specimens with a darker brown thalline margin he identified as *A. variegata*. Neither *A. gallica* nor *A. variegata* occur in North America.

In North America, because mature thalli in some populations are comprised of only apothecia with brown thalline margins, the calciphile *Acarospora canadensis* H. Magn. could be confused with *A. toensbergii* (Brodo 2016). The apothecia of *A. canadensis* do not arise from an endolithic hypothallus. Instead, it has an epilithic thallus of brown areoles with immersed apothecia that eventually expand and reduce the thallus to a thalline margin. Besides the ontogeny of its apothecia, *A. toensbergii* differs from *A. canadensis* especially in occurring on non-calcareous rocks, having larger cells in its cortex (5–6 µm vs. 1–2 µm in *A. canadensis*), and a higher hymenium (90–120 µm vs. 65–85 µm in *A. canadensis*) (Magnusson 1929). Previously (e.g., Knudsen 2007), the first author considered *A. canadensis* to be a synonym of *A. glaucocarpa* (Ach.) Körber but with further study of the specimens we now consider it a distinct species. Though both species can look the same and have similar anatomical measurements, *A. glaucocarpa* differs in that it always has a distinct jagged algal layer interrupted by wide hyphal bundles forming algal palisades. *Acarospora canadensis* has an even algal layer uninterrupted by hyphal bundles.

Acarosporaceae are relatively rare in Alaska, compared to farther south in North America (Bruce McCune, pers. com.) and we suspect that *Acarospora toensbergii* could occur in Canada or in Asia. It may also be a naturally rare species, a survivor of the radical changes of the Ice Age in North America (Ehlers et al. 2016). In addition to the specimens that we examined directly, two other specimens of *A. toensbergii* were determined by M. Schultz and verified via digital images by K. Knudsen.

Additional specimens examined. – **U.S.A. ALASKA**. KENAI PENINSULA CO.: Kenai Fjords National Park, near Harding Icefield Trail, ridge above Exit Glacier, alpine tundra with scattered low shrubs and metasedimentary outcrops, 60°11′10″N, 149°40′27″W, 795 m, 11.vii.2015, in rivulet on flushed boulders of metamorphic sedimentary rock, *M. Schultz 16928f* (ALA, HB); Kenai Fjords National Park, Exit Glacier Campground, near Exit Glacier Creek, floodplain forest with cobble openings and thickets of *Populus balsamifera, Alnus* and *Salix,* 60°11'27″N, 149°37'27″W, 112 m, 12.vii.2015, on cobbles of metamorphic sedimentary rock, growing with *Thelignya lignyota* and *Placynthium asperellum*, *M. Schultz 16936b* (ALA, HB)

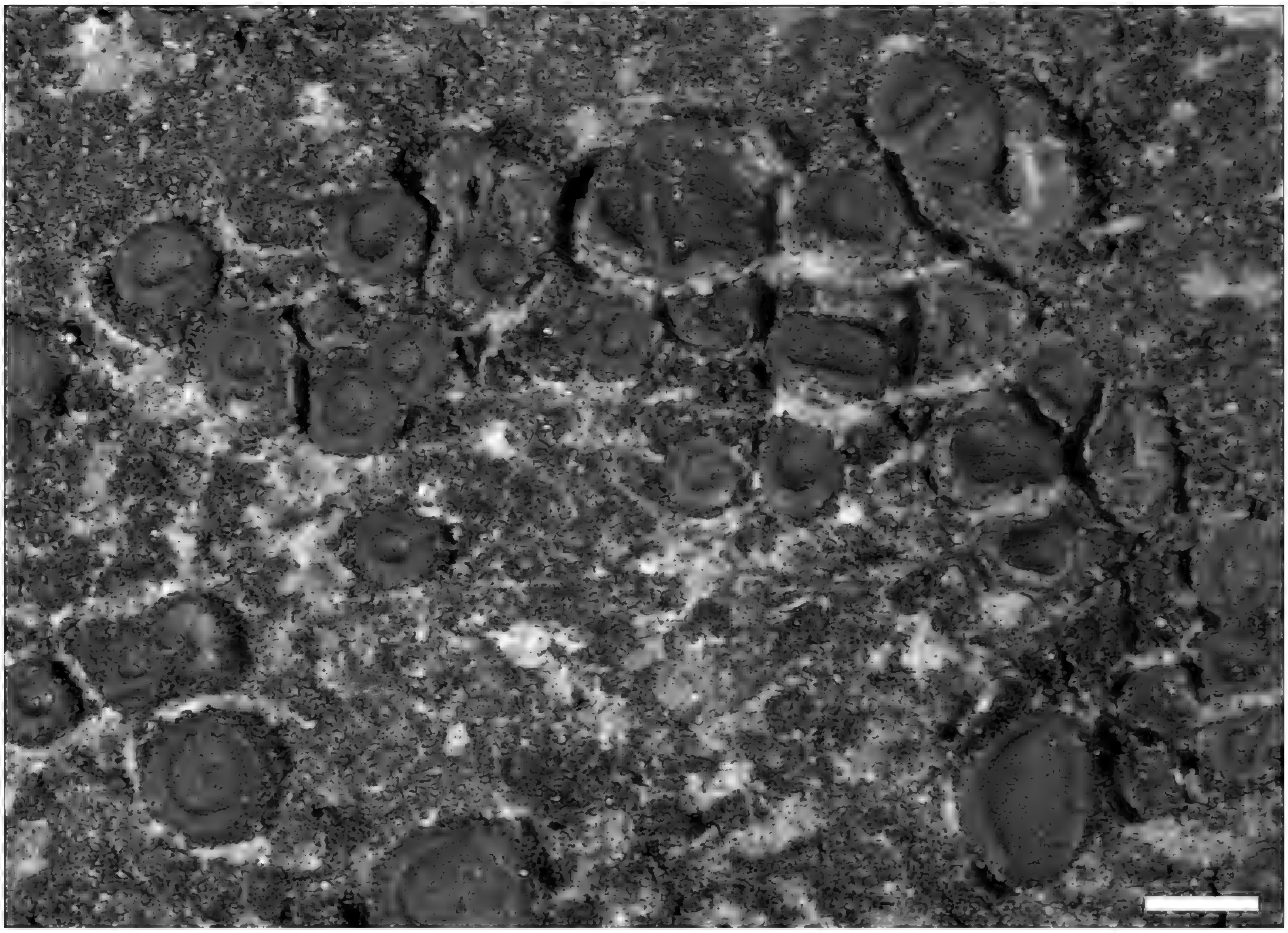

Figure 2. Morphology of *Acarospora toensbergii* (holotype, *Tønsberg 45624*). Scale = 0.5 mm.

Selected specimens of A. canadensis examined. – **CANADA. MANITOBA**. Winnipeg, Birds Hill Provincial Park, 50°0′52″N, 96°54′53″W, 266 m, 20.vii.2002, on limestone pebble in open, *I.M. Brodo 31240* (CANL). **ONTARIO.** BRUCE CO.: Fathom Five National Marine Park, Flowerpot Island, 45°18′14″N, 81°36′43″N, 180 m, 22.ix.2008, on dolomite, *R.C. Harris 55019* (NY); Bruce Peninsula, S end of Georgian Bay, 45°12′13″N, 81°18′32″N, 8 m, 16.vi.2014, on calcareous rock, *J. McCarthy 2414* (NY, UCR, hb. Kocourková & Knudsen). **U.S.A. CALIFORNIA.** SAN BERNARDINO CO.: San Bernardino Mountains, 3N03, Smarts Ranch Rd., along seasonal stream bed, 34°15′39″N 116°43′36″W, 1961 m, 5.xi.2015, on limestone, *K. Knudsen et al. 17024* (UCR).

Acknowledgements

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Parmotrema perforatum new to Canada from Kejimkujik National Park and National Historic Site in Nova Scotia, Canada

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ABSTRACT. – *Parmotrema perforatum* is a large macrolichen that is common in southeastern North America. We report the first Canadian records from Kejimkujik National Park and National Historic Site in Nova Scotia, Canada. The taxon was located during surveys of the nationally rare Atlantic Coastal Plain habitat in southern Nova Scotia where many disjunct species of vascular plants, bryophytes, and other lichens reach their northern limit in eastern North America.

KEYWORDS. – Conservation, biogeography, temperate.

INTRODUCTION

Parmotrema perforatum (Jacq.) A. Massal. is a large foliose lichen (thalli 2–15 cm in diameter) that is characterized by 10–20 mm wide lobes with ciliate margins and a mostly green-grey upper surface; substipitate and perforated apothecia that are <20 mm in diameter with brown disks and thalline margins; and a lower surface that is centrally rhizinate and black and brown with mottles of ivory near the periphery (Nash & Elix 2002, Widhelm et al. 2016). The taxon typically occurs on upper branches and trunks of trees in open and exposed habitats (Flenniken 1999, Hinds & Hinds 2007, Nash & Elix 2002). The upper cortex is KOH+ yellow, C-, KC-, PD- due to the presence of atranorin and the medulla is K+ yellow turning red, C-, KC-, P+ orange due to the presence of norstictic acid (Harris 1995; Harris & Ladd 2005; Lendemer et al. 2013, 2016; Nash & Elix 2002; Widhelm et al. 2016). Its global distribution includes eastern North America, Mexico, southern Africa, and Ireland (Hinds & Hinds 2007). In North America, the species distribution is closely affiliated with the Southeastern Coastal Plain, ranging from eastern Mexico to Florida, and north to Massachusetts (Lendemer et al. 2015). Its North American distribution also includes non-coastal plain regions such as the Ozark Mountains, the southern Appalachian Mountains, and the Piedmont (Brodo et al. 2001; Harris & Ladd 2005; Lendemer et al. 2013, 2015).

The Southeastern Coastal Plain contains many endemic bryophyte, lichen, and vascular plant species (Estill & Cruzan 2001, Fleming 2012, Lendemer et al. 2016, Noss et al. 2015, Sorrie & Weakley 2001). Some Coastal Plain plant species, such as *Drosera filiformis* Raf. and *Hydrocotyle umbellata* L., *Sphagnum cyclophyllum* Sull. & Lesq., and *S. macrophyllum* Brid., are known to occur as far north as easternmost Atlantic Canada, which is over 300 kilometers north of the Coastal Plain physiographic region (Fenneman 1938, Noss et al. 2015, Thorne 1993). In Atlantic Canada, this northern extension is most prominent in southern Nova Scotia, where climatic conditions are suitable and Coastal Plain habitats are locally abundant, and where approximately 100 Coastal Plain vascular plant species occur (Crowley et al. 2011; Fernald 1921, 1922; Keddy & Wisheu 1989; Wisheu 1994). Some lichen species, such as *Coccocarpia palmicola* (Sprengel) Arv. & D. J. Galloway, *Fuscopannaria leucosticta* (Tuck.) P. M. Jørg., *Parmelinopsis horrescens* (Taylor) Elix & Hale, *Trypethelium virens* Tuck., and *Usnea strigosa* (Ach.) A. Eaton, exhibit similar distribution patterns north into Nova Scotia and provide strong evidence for the potential of additional discoveries of lichen species with Coastal Plain affinities in southern Nova Scotia (Brodo et al. 2001). Here,

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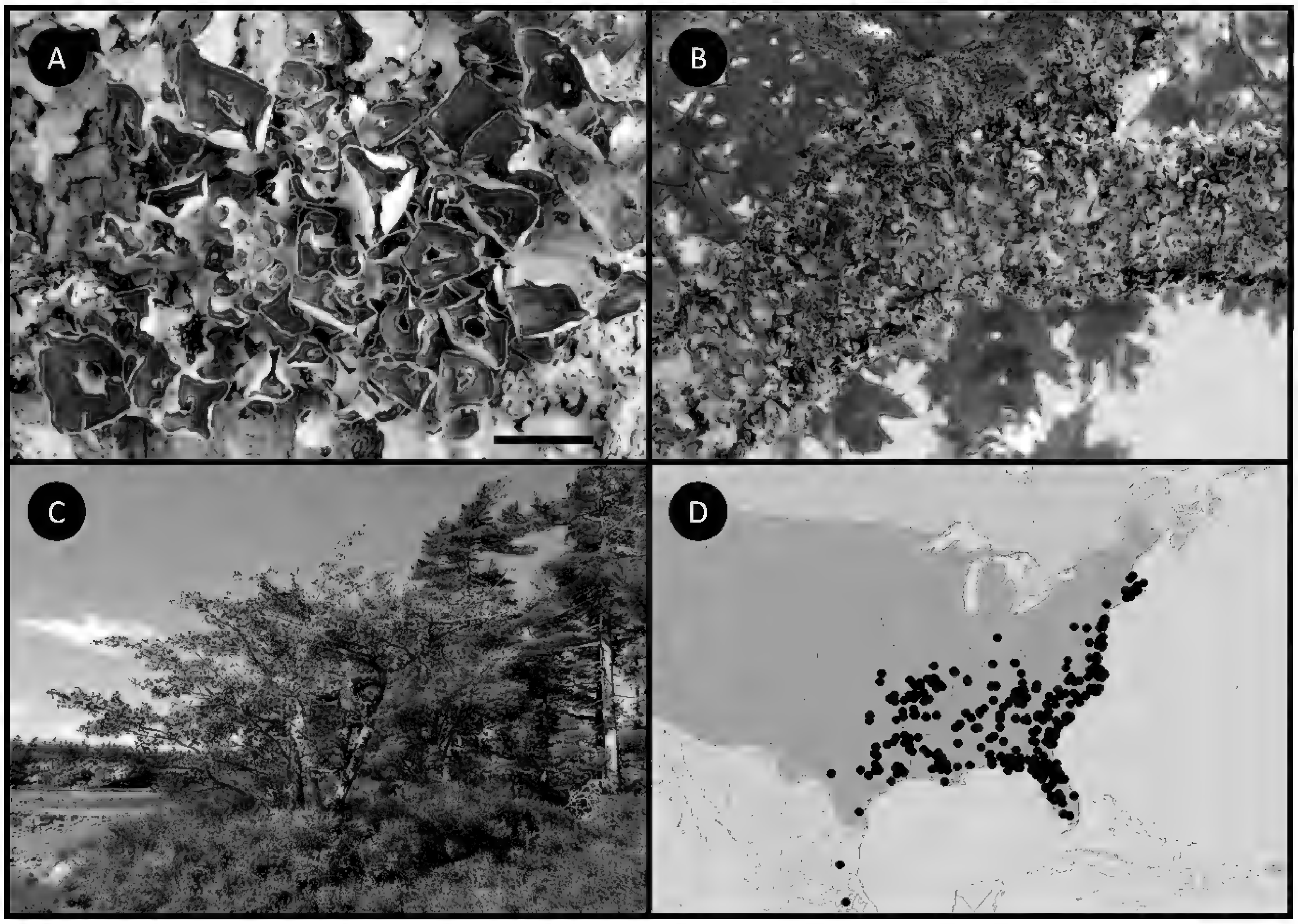

Figure 1. Morphology, habitat and geographic distribution of *Parmotrema perforatum*. **A**, Gross morphology (*A. Belliveau AGB00500.1*, CANL, ACAD), scale = 1 cm. **B**, habit of *P. perforatum* on branch of tree. **C**, habitat where the species was located in Canada. **D**, Geographic distribution of *P. perforatum* in North America, with the Canadian population indicated by a yellow star.

we report the first occurrence of *Parmotrema perforatum* in Canada from Kejimkujik National Park and National Historic Site on the southern peninsula of Nova Scotia.

Materials and Methods

Study Site. – Our study area included lakeshores and adjacent wetlands, riparian zones and forest of 36 lakes in six counties (Annapolis, Digby, Yarmouth, Shelburne, Queens, Lunenburg) of southern Nova Scotia (Fig. 1D), totalling a linear distance of approximately 800 km of lakeshore (B. Toms, pers. comm.). Studied lakes ranged from <1 km from the Atlantic Coast of Nova Scotia, to as far as 55 km away from the/ coast, with a maximum elevation of 120 meters. They were located within the Acadian Forest Ecozone (Rowe 1972) and the Western Ecoregion of Nova Scotia (Neily et al. 2003). Five of the six counties are also within the UNESCO Southwest Nova Biosphere Reserve (UNESCO, 2001). These lakes were deemed high-priority for conservation efforts by the Atlantic Coastal Plain Flora Recovery Team (Environment Canada and Parks Canada Agency 2016), and each includes at least one of 11 Coastal Plain species federally and legally listed as species at risk of extinction by the Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2017). The determination and updating of information on species population abundance and distribution, habitat availability and suitability, and threats, on these lakes is an objective stated in federal recovery documents (Environment Canada and Parks Canada Agency 2010).

Surveying. – From 2009 to 2016, surveys for federally protected vascular plant species were conducted by five professional botanists, of which one was considered a capable lichenologist for the entire duration of the surveys, and another became one near the end of the survey period. Surveys were predominantly carried out on foot, except for some portions of generally narrow and/or steep shoreline which

were examined by slow canoeing close to shore. Survey effort was concentrated along lakeshores and shoreline peatlands, but also included some floodplain and uplands adjacent to lakeshores. Areas covered were documented using a GPS unit set to save position coordinates every 20 seconds. For federally or provincially listed species, provincially rare species (those species with provincial status ranks [S-ranks] of S1 to S3S4 and/or provincial General Status Ranks of At Risk, May Be At Risk, or Sensitive) or non-field-identifiable species, we recorded locations by GPS (accurate to 10 m or less), along with information on population size and extent, habitat, and associated species. For these rarer taxa, we also collected specimens. All data collected through these lakeshore surveying efforts have been incorporated into the Atlantic Canada Conservation Data Centre database for permanent storage. Maps for fieldwork and reporting were produced in Esri ArcMap 9 or 10.

Identification. – Specimens were identified using a stereo microscope and standard chemical spot tests with paraphenylenediamine in ethyl alcohol, 10% potassium hydroxide, and alkaline iodine (Brodo et al. 2001). Chemistry was further examined using an ultraviolet light chamber and thin-layer chromatography following Culberson and Kristinsson (1970) and Orange et al. (2001) in solvents A, B, and C. Images were captured using an Olympus OM-D E-M1 Mirrorless Micro Four Thirds Digital Camera. Specimens are housed at the Canadian Museum of Nature (CANL) in Ottawa, Ontario, and the E.C. Smith Herbarium (ACAD) at Acadia University in Wolfville, Nova Scotia.

Results

Between 100 and 1000 thalli of *Parmotrema perforatum* were observed at two localities on Kejimkujik Lake in Kejimkujik National Park and National Historic Site (Fig. 1D). The first location was on an unnamed 0.4-hectare island (herein called “Parmotrema Island”) between Freeman Island and Dark Island, and the second location was approximately 350 meters to the northwest on the 1.3-hectare Dark Island. Parmotrema Island is forested with mature *Acer rubrum*, *Picea mariana*, *Pinus strobus*, and *Quercus rubra*, with dense shrubs (*Gaylussacia baccata*, *Ilex verticillata*) along the island’s upland periphery (Fig. 1C). Dark Island is forested with an old-growth *Tsuga canadensis* forest, with *A. rubrum* and dense *G. baccata* along its upland periphery. Thalli were most abundant throughout the upland portion of Parmotrema Island, on various substrates including the living bark of *A. rubrum*, *I. verticillata*, *P. mariana*, *P. strobus*, and *Q. rubra*, and on decaying *P. mariana* woody debris (Fig. 1B). Thalli were especially prolific over five meters high in tree canopies, or on the most exposed tree trunks and branches closer to the ground. Smaller numbers of thalli were found scattered on lower, less exposed trunks, branches, and a few shrubs. On Dark Island, one occurrence was observed on the larger limbs of the upper canopy (>10 m) of an *A. rubrum* between open, east-facing lakeshore and old-growth *T. canadensis* forest.

The specimens of *Parmotrema perforatum* that we examined were distinguished by a lower surface with dark coloration in the central portions and with a ~1 cm white zone along the margins, a maculate upper cortex, abundant perforated apothecia that were occasionally as wide as 20 mm, and norstictic acid in the medulla (Fig. 1A). The material matches well the many published accounts of this species (e.g., Harris 1995; Harris & Ladd 2005; Lendemer et al. 2013, 2016; Nash & Elix 2002).

We also searched the following databases for existing Canadian occruences of this species: Canadensys, Canadian Museum of Nature, Consortium of North American Lichen Herbarium, Global Biodiversity Information Facility, and the New York Botanical Garden. This search led to six previously collected Canadian specimens that were labelled as *Parmotrema perforatum*. After examination of the vouchers we found that that all of them represented other taxa. Four collections from British Columbia (*Goward 83-39b, 83-83*, *83-166*, and *Noble & Crane 5361*, all at UBC) appear to have been entered into Canadensys and the Global Biodiversity Information Facility incorrectly. On the packets, they were all labelled as *P. perlatum* (Huds.) M. Choisy and we confirmed that as the correct identification. One collection from Ontario (*Macoun 27*, FH) proved to represent the sorediate species *P. margaritatum* (Hue) Hale, and another specimen from Québec (*Lepage 143*, QFA) represented a mixture of to *Hypogymnia physodes* (L.) Nyl. and *Parmelia sulcata* Taylor.

Discussion

The two *Parmotrema perforatum* localities that we discovered are the first confirmed occurrences of the species in Canada. We distinguished *P. perforatum* from other non-sorediate and non-isidiate

Parmotrema and *Parmotrema*-like species with marginal cilia or cilia-like marginal rhizines in eastern North America using the key provided in Appendix II. Several species from this group can be difficult to separate and may require mature specimens and/or chemical analyses for identification. Our results suggest that similar species with a more southern-affinity might also be present in southern Nova Scotia, including taxa from the key in Appendix II.

Our survey in Nova Scotia suggests that *Parmotrema perforatum* warrants a provincial conservation rank of S1 (Critically Imperilled). Lichen surveys have been particularly extensive in southern Nova Scotia, largely due to ongoing efforts to detect and monitor *Erioderma pedicillatum* (Hue) P.M.Jørg., a lichen federally-listed as endangered (COSEWIC 2014) and supported by provincial policy requiring targeted lichen surveys before the occurrence of forestry activities. Other surveys have included efforts to monitor Atlantic Coastal Plain vascular plant species along 36 high-priority lakes. In addition to the lakeshore surveys, at least 1906 kilometers of focused lichen surveys by experienced lichenologists have occurred in the six southern Nova Scotia counties where broadly similar vegetation communities (shrubby forests with *Acer*, *Quercus*, and/or *Pinus*) to the ones found on Kejimkujik Lake are known to occur (B. Toms, pers. comm.). Based on lichen records in the area (Atlantic Canada Conservation Data Centre 2017, CNALH 2017), many other unpublished surveys have also occurred in southern Nova Scotia. This relatively extensive coverage, along with the comparative ease of recognizing *P. perforatum* suggests that it is indeed rare. In addition, the possibility of tree blow-down in its only known localities is high. Given the high likelihood of rarity, and the high potential for significant site disturbance, this species warrants provincial conservation concern. The new discovery of this large macrolichen species in a relatively well-surveyed region also highlights the importance of continuous survey efforts to better understand the rare and threatened species in south-western Nova Scotia, and their status in Canada, North America, and globally (Atlantic Canada Conservation Data Centre 2017, Cameron & Toms 2016, Government of Canada 2017, McMullin 2012).

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APPENDIX I – SPECIMENS EXAMINED

Specimens of Parmotrema perforatum examined. – **CANADA. NOVA SCOTIA.** QUEENS CO.: Kejimkujik National Park and National Historic Site, Kejimkujik Lake, Parmotrema Island, 24.viii.2016, on bark and woody debris, *A. Belliveau AGB00500.1* (ACAD, CANL), 15.xi.2016, *T. McMullin 18650* (CANL).

Specimens previously identified as Parmotrema perforatum that belong to other taxa. – **CANADA. BRITISH COLUMBIA.** CAPITAL REGIONAL DIST.: Vancouver Island, Botanical Beach Provincial Park, 4 km SW of Port Renfrew, near sandstone beach fringed by *Picea sitchensis*, on *Picea*, 14.viii.1975, *W.J. Noble & A. Crane 5361* (UBC = *Parmotrema perlatum*). ALBERNI-CLAYOQUOT REGIONAL DIST.: Vancouver Island, harbour area adjacent to Ucluelet, at water's edge on shady side of N-facing open area, on branches of *Picea sitchensis*, 20.ii.1983, *T. Goward 83-166* (UBC = *Parmotrema perlatum*); Vancouver Island, edge of town of Ucluelet, 30.i.1983, on rock over bird-lined rock above upper tide line, *T. Goward 83-83* (UBC = *Parmotrema perlatum*); Vancouver Island, road edge near town of Ucluelet, 28.i.1983, on branches of wind-felled *Pinus contorta*, near crown, *T. Goward 83-39b* (UBC = *Parmotrema perlatum*). **ONTARIO:** location uncertain, 2.v.1905, *J. Macoun III 27* (FH = *Parmotrema margaritatum*). **QUÉBEC:** Ste-Anne, 11.v.1935, on rock, *E. Lepage 143* (QFA = *Hypogymnia physodes* and *Parmelia sulcata)*.

APPENDIX II – IDENTIFICATION KEY

Below we provide an identification key for mature, non-sorediate, non-isidiate *Parmotrema* and *Parmotrema*-like species with marginal cilia or cilia-like marginal rhizines in eastern North America. Note that small or immature *Parmotrema* thalli (typically those <1 cm in diameter) with norstictic acid can be either *P. hypotropum* (Nyl.) Hale or *P. perforatum*, as young thalli of *P. hypotropum* can be esorediate (Harris & Ladd 2005).

1. Upper surface reticulately cracked to the lobe margin (best seen under 10× or greater magnification) creating a pattern of ± isodiametric polygons 0.1–0.2 mm broad, the reticulations developing into a pattern of cracks in older portions of the thallus; lower surface dark and rhizinate to the lobe margin; apothecia up to 10 mm in diameter; medulla KOH+ yellow to red (salazinic acid) .... **P. cetratum** (Ach.) Hale (≡ *Rimelia cetrata* (Ach.) Hale & Fletcher)
1. Upper surface not cracked; lower surface variable; apothecia up to 20 mm in diameter; salazinic acid present or absent **2**

2. Cortex emaculate; lower surface dark brown to black throughout; lobes 1–8 mm in diameter; apothecia up to 14 mm in diameter and never perforate **3**

3. Medulla PD-, K+ purple-brown (lividic acid), KC+ purple-brown or red; lobes 1–4 mm in diameter; apothecia 1–5(–8) mm in diameter .... ***Hypotrachyna livida*** (Taylor) Hale
3. Medulla PD+ red or red-orange, K+ dirty yellow-brown, or K-, KC+ pink or red (protocetraric acid); lobes 2–8 mm in diameter; apothecia up to 14 mm in diameter .... **P. submarginale** (Michx.) DePriest & B. Hale (= *P. michauxianum* (Zahlbr.) Hale)

2. Cortex maculate (except occasionally in *P. eurysacum* or *P. despectum*); lower surface brown throughout or dark brown to black with pale or mottled marginal region; lobes up to 20 mm in diameter; apothecia up to 20 mm in diameter and often perforate **4**

4. Lower surface dark brown throughout **5**

5. Lobe margins crenate to erose; subpalmately divided lacinae absent; upper cortex sometimes faintly maculate; thallus coriaceous, 260–300 µm thick; marginal cilia rare to sparse, 1–3 mm long; ascospores 10–14 × 6–10 µm .... ***P. despectum*** Kurok.

5. Lobe margins subentire to broadly crenate; long, subpalmately divided lacinae present; upper cortex emaculate; thallus membranaceous, 150–160 µm thick; marginal cilia frequent, often divided, 1.5-5 mm long; ascospores 14–16 × 7–9 µm............................ ***P. eurysacum*** (Hue) Hale

4. Lower surface black with a pale mottled marginal region **6**

6. Medulla UV+ bright blue-white, KC+ pink (alectoronic acid).. **7**

7. Medulla, especially near the apothecia, KOH- (norstictic acid absent) .... ***P. subrigidum*** Egan s. str.

7. Medulla, especially near the apothecia, KOH+ yellow turning red (norstictic acid present) .... ***P. subrigidum*** Egan s. lat.

6. Medulla UV-, KC- (alectoronic acid absent)..**8**

8. Medulla AI+ blue, KOH+ yellow (constictic and stictic acids, occasionally with traces of norstictic acid); Louisiana and Texas.............................. ***P. preperforatum*** (W.L.Culb.) Hale

8. Medulla AI-, KOH+ yellow turning red (connorstictic and norstictic acids); mostly the southeastern coastal plain and southern Appalachians........... ***P. perforatum*** (Jacq.) A.Massal.